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Areawide Waste Treatment Management Plan for the Greater Houston Area

Houston-Galveston Area Council, TX

Prepared for

Environmental Protection Agency, Washington, DC

Dec 77

Public Law 92-500
92nd Congress, S. 2770
October 18, 1972

PB 295184

An Act

SUMMARY REPORT

To amend the Federal Water Pollution Control Act.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Federal Water Pollution Control Act Amendments of 1972".

SEC. 2. The Federal Water Pollution Control Act is amended to read as follows:

AREAWIDE WASTE TREATMENT

"TITLE I—RESEARCH AND RELATED PROGRAMS

MANAGEMENT PLAN

"DECLARATION OF GOALS AND POLICY

"SEC. 101. (a) The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act—

FOR THE

"(1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;

"(2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;

GREATER HOUSTON AREA

"(3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;

"(4) it is the national policy that Federal financial assistance be provided to construct publicly owned waste treatment works;

"(5) it is the national policy that areawide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State; and

DECEMBER 1977

"(6) it is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans.

"(b) It is the policy of the Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, to plan the development and use (in-

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The unique aspects of the 208 planning program include: 1) understanding the significance of water pollutants coming from sources other than municipal and industrial wastewater treatment plants, 2) emphasizing not only what needs to be done but also how and when it is to be accomplished and who will be responsible, 3) developing local solutions to local problems, and 4) public participation throughout development.

Since the 208 Program is an on-going effort, new and better information will be utilized. In the meantime, the results of the initial effort will serve as a base for making informed decisions concerning water quality.

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ALTERNATIVES/RECOMMENDATIONS SUMMARY REPORT
AREAWIDE WASTE TREATMENT MANAGEMENT PLAN FOR THE GREATER HOUSTON AREA

TABLE OF CONTENTS

A BRIEF INTRODUCTION TO THIS REPORT 1
WHAT IS 208 PLANNING? 2
WHY 208 IN HOUSTON? 3
WHAT IS THE PLANNING PROCESS? 4
WHAT ARE THE MAJOR FINDINGS AND RECOMMENDATIONS OF THIS PROGRAM?. 6
SOME BACKGROUND ON TECHNICAL PLANNING 8
    Standards 8
    Pollutants 8
    Sources 8
    Critical Conditions 9
    Models. 9
    Controls 10
HOW WERE THE TECHNICAL SUBPLANS DEVELOPED?. 12
    Dry Weather Strategies. 12
    Regionalization Alternatives. 13
    Wet Weather Strategies. 13
WHAT ABOUT COSTS? 14
INTRODUCTION TO SPECIFIC TECHNICAL SUBPLANS 16
LAKE HOUSTON SUBBASIN 18
    Spring Creek (Segment 1008) 20
    Cypress Creek (Segment 1009). 22
    Lake Houston (Segment 1002) 24
CLEAR LAKE SUBBASIN 26
    Clear Creek Nontidal (Segment 1102) 28
    Clear Creek Tidal (Segment 1101). 30
    Clear Lake (Segment 2425) 32
    Armand Bayou. 34
    Dickinson Bayou Nontidal (Segment 1104) 36
    Dickinson Bayou Tidal (Segment 1103). 38
HOUSTON SHIP CHANNEL SUBBASIN 40
    Houston Ship Channel. 42
    San Jacinto River Tidal (Segment 1001). 44
    Buffalo Bayou 46
    Other Tributaries of the Houston Ship Channel 47
WHO WILL CARRY OUT THE PLAN?. 48
WHAT ARE THE MANAGEMENT FUNCTIONS?. 49
WHAT IS THE PRESENT SITUATION?. 50
WHAT ARE THE MANAGEMENT ALTERNATIVES? 51
    Regulatory and Compliance Management Alternatives 51
    Water Quality Planning Alternatives 51
    Wastewater Treatment Management Alternatives. 52
    Nonpoint Source Control Management Alternatives 53
    Management/Coordination Alternatives. 54
    Summary of Management Alternatives/Recommendations. 55
MORE ABOUT THE WATER QUALITY COUNCIL. 56
    Membership. 57
WATERSHED COORDINATION. 58
IMPLEMENTATION. . . WHAT NEEDS TO BE DONE?. 59
ENVIRONMENTAL IMPACT. 60
WHO WILL REVIEW AND APPROVE THE PLAN? 61
GREATER HOUSTON 208 PROGRAM PARTICIPANTS. 62
LIST OF DEPOSITORIES FOR PROGRAM DOCUMENTS. . . . . Inside Back Cover

HOUSTON-GALVESTON AREA COUNCIL

The Houston-Galveston Area Council (H-GAC) is a voluntary association of local governments and local elected officials in the 13-county Gulf Coast State Planning Region. Its service area encompasses the counties of Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller, and Wharton. It is one of 24 regional councils of government in Texas and one of approximately 600 in the United States.

Organized in 1966, the H-GAC provides a forum for the discussion of areawide concerns and promotes regional cooperation through comprehensive planning and services to local governments.

Membership in the H-GAC is open to all counties, cities, independent school districts, and soil and water conservation districts situated in the 13-county service region. At the end of 1977, the H-GAC had 110 member governments--13 counties, 77 cities, 10 school districts, and 10 soil and water conservation districts.

A BRIEF INTRODUCTION TO THIS REPORT AND WHAT IT IS ABOUT...

This report summarizes findings and recommendations of a three-year water quality planning effort in the Houston Area. The program was funded in total by a grant from the U. S. Environmental Protection Agency (EPA) to the Houston-Galveston Area Council (H-GAC). The plan was authorized under the provisions of Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500).

Planning programs under Section 208 are being conducted nationwide. The Houston Area program is one of 176 plans being prepared for urban areas designated for special examination due to substantial water quality problems. There are eight such designated programs in the State of Texas. For those areas not being examined so intensively, the State has primary planning responsibility.

Certain unique aspects of 208 planning programs include: (1) The first major effort undertaken to understand the significance of water pollutants coming from sources other than municipal and industrial wastewater treatment plants, (2) An emphasis on not only what needs to be done but also on how and when it is to be accomplished and who will be responsible, (3) The opportunity to develop local solutions to local problems, and (4) Public participation throughout program development.

The 208 Program will be an on-going effort. Findings and recommendations will be updated as new and better information becomes available. In the meantime, the results of the initial effort will provide a basis and a system for making informed decisions concerning water quality in the Greater Houston Area.

With that, we can turn our attention to the specific results of the Houston Area 208 Program. Additional background information is first provided to better acquaint the reader with the technical details of 208 planning. It is hoped that this will enable further understanding and aid the public in making inputs to the plan.

WHAT IS 208 PLANNING?

In its concern for the condition of the Nation's waterways, the United States Congress enacted the Federal Water Pollution Control Act Amendments of 1972. The overall objective of the law is to

> "restore and maintain the chemical, physical and biological integrity of the Nation's waters."

To achieve this objective, the law established a national goal to have, by July 1, 1983, water in the Nation's streams which provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water. This 1983 goal is commonly referred to as "fishable/swimmable".

The United States Environmental Protection Agency (EPA) was charged with the responsibility for implementing the Federal Water Pollution Control Act Amendments (Public Law 92-500).

SECTION 208 of the Federal Act encourages local governments to work together to find and implement solutions to their common water quality management problems. For this reason, local areawide agencies were designated to accomplish the planning for areas identified by the Governors of each state as having potentially significant water quality problems.

The Federal Water Pollution Control Act Amendments (FWPCAA) and EPA regulations detail specific requirements for these planning efforts. Notable among these are:

- Assessment of existing and potential water quality problems
- Assessment of water quality problems caused by nonpoint sources of pollution (for example, stormwater runoff from urban and agricultural areas) and steps necessary to abate them
- Needs for municipal wastewater treatment systems over a 20 year period
- Inventory of municipal and industrial sources of pollutants and projections of future wasteloads
- Identification of those agencies necessary to manage and implement the plan
- Determination of level of water quality necessary to ensure progress toward fishable/swimmable goals (water quality standards)
- Assessment of the impacts associated with the recommended plan
- Encourage and provide for input from the public in developing and carrying out the plan

WHY 208 IN HOUSTON?

Under the provisions of Section 208, particular emphasis is to be placed on those areas with substantial water quality problems due to urbanization and industrial concentration. The Greater Houston 208 Area was designated by EPA for intensive planning on April 22, 1975, following recommendation by the Governor.

The Houston-Galveston Area Council (H-GAC) has been designated by the Governor of the State of Texas as the planning agency to develop this comprehensive areawide waste treatment management plan for the Greater Houston Area. The area covered by the Greater Houston 208 Program includes all of Harris County and portions of Brazoria, Fort Bend, Galveston, Montgomery, and Waller Counties. The 2,450 square mile planning area lies totally within the San Jacinto River Basin.

The area is known as the nation's energy capital, with the world's largest petrochemical complex and the nation's third largest port. Although a sprawling urban-industrial center, the area also supports agricultural activities such as rice farming. Industry has its heaviest concentration in the east and southeast of Harris County with intense industrial activity along the Houston Ship Channel. These areas have the bulk of the petrochemical and steel industries with oil field equipment manufacturers and oil and gas storage facilities scattered throughout the region. There are approximately 320 permitted industrial wastewater dischargers.

The strong economy of the Houston area is evidenced by rapid population growth. The estimated population in 1975 was 2.26 million, with projections for 1995 exceeding 3.5 million. Growth has taken place throughout the planning area in a generally dispersed manner. Approximately 270 municipal sewage treatment plants serve area residents.

Another factor leading to 208 designation is a complex institutional setting. The City of Houston is most prominent with its incorporated area comprising approximately 25 percent of the 208 planning area. (The extraterritorial jurisdiction, ETJ, covers most of the 208 area.) In addition, there are 42 municipalities, six counties, and more than 300 water districts involved in some or all aspects of water quality management. Special purpose regional authorities also work with local government and private industry in waste treatment management.

The Houston area has a semi-tropical climate which affords considerable opportunity for outdoor recreation. Much of this activity centers on use of the many streams, lakes and bays. Certain unique features of the area which can pose problems for water quality management include close proximity to the Gulf Coast, rainfall amounts and intensity, flatness of the terrain, soils unsuitable for septic tanks, and land subsidence.

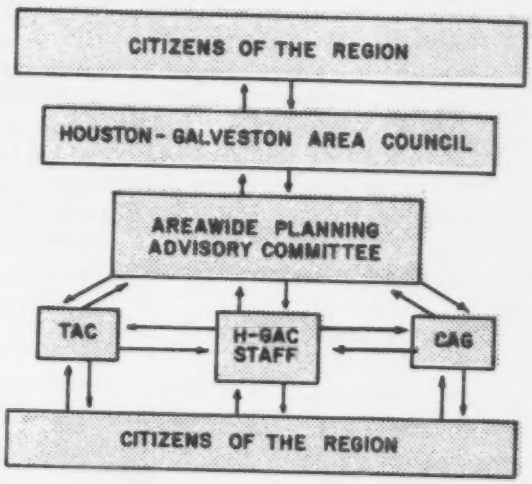
WHAT IS THE PLANNING PROCESS?

The H-GAC 208 water quality management planning program is designed as an ongoing planning process with particular focus on the development of basic methodologies. This will allow for continual reassessment, refinement and updating of the program and be useable by ongoing planning and management agencies.

The work was performed, under the direction of the H-GAC Environmental Planning Division, by contract with local agencies, private consultants, the Texas Department of Water Resources (TDWR), and the H-GAC staff.

The Environmental Protection Agency, the Texas Department of Water Resources, and the H-GAC Executive Committee were active program participants providing guidance and supervision for conformance to Federal and State policy and requirements.

Another important aspect of program development and execution was the extensive participation by Advisory Committees. The Areawide Planning Advisory Committee (APAC), a group appointed by the Governor, reviews and comments on all planning policies and plan outputs. The Technical Advisory Committee (TAC) was appointed by the H-GAC Executive Committee and charged with technical analysis of 208 planning elements. The Citizens Advisory Group (CAG) is an open membership group serving as a forum for public review and a means of communication between the lay citizen and the technical planners. (A list of 208 program participants can be found on Page 62.)



Throughout the process, attempts were made to inform the general public of the program and study findings, and to solicit input through the use of the news media, special mailings, public workshops and hearings.

This report presents a summary of findings and recommendations prepared as part of the 208 plan. Copies of the complete text of all reports produced thus far are available for study at locations throughout the planning area (see inside back cover for the List of Depositories for Program Documents).

A diagram illustrating the sequence of planning activities, the specific tasks and associated reports is presented on the following page.

PLANNING PROCESS

STEPS	ACTIVITIES	OUTPUTS
GOALS AND OBJECTIVES	Federal Water Pollution Control Act Amendments of 1972 Citizen Goals & Objectives	Goals and Objectives Report, 9-76
PROGRAM DESIGN	EPA Regulations & Guidelines State Requirements and Guidance Elected Official Input Develop Work Plan	Project Design Report, 1-76
INVENTORY	Municipal & Industrial Point Source Solid Waste, Sludge, & Subsidence Water Data Base Socio-Economic Data Institutional Data Base Control Strategies	Point Source Analysis Inventory, Water Demands, & Problem Area Identification, 7-77 Solid Waste Site Survey & Report, 8-76 Sludge & Residual Waste Inventory, 10-76 Subsidence & Related Effects on Wastewater Collection & Treatment Facilities, 11-76 "How Clean Do You Want Your Streams?" Revised 5-77 Current Wastewater Management, 5-77, Revised 11-77 Control Strategies, Costs & Impacts for Nonpoint Sources, 7-77 Control Strategies, Costs & Impacts for Point Sources, 7-77 Non-Structural Control Strategies for Nonpoint Sources of Water Pollution-Supplemental Report, 9-77
METHODOLOGY	Steady & Non-Steady State Models Population & Land Use Projection Model Wasteload Projection Method Water Use Projection Method Nonpoint Source Sampling Program	Point Source Analysis Inventory, Water Demands, & Problem Area Identification, 7-77 Nonpoint Source Sampling Design Report, 7-77
PROJECTIONS	Population & Land Use Point Source Wasteloads Nonpoint Source Projections	Population & Land Use, 7-76
ANALYSIS AND ASSESSMENTS	Point Source Nonpoint Source Institutional Analysis Stream Segment Analysis	Control Strategies, Costs & Impacts for Point Sources, 7-77 Assessment of Nonpoint Sources, 7-77 Management Assessment, 7-77, Revised 11-77 (Included in Development of Alternative Technical Plans)
DEVELOPMENT OF ALTERNATIVE TECHNICAL PLANS	Broad Management Options Management Alternatives Alternative Technical Subplans	Broad Management Options, 7-77, Revised 11-77 Alternative Management Systems, 11-77 Alternative Technical Subplans Report, 12-77
PLAN RECOMMENDATIONS	Screen Subplans Screen Management Alternatives	Summary Report, 12-77
PLAN IMPLEMENTATION	Requirements for Implementation	Implementation Requirements (to be completed)
PLAN ASSESSMENT	Environmental Impact Assessment	Environmental Impact Assessment (to be completed)
PLAN APPROVAL	Hearing Results Elected Official Input Advisory Committee Review Citizen Review	

WHAT ARE THE MAJOR FINDINGS AND

General

* Findings/recommendations are only as good as input data and analytical tools used (e.g., population/land use projections, wasteload calculations, stream models): KEEP PROGRAM UP-TO-DATE AND RESPONSIVE TO MANAGEMENT SYSTEM AND PUBLIC PARTICIPATION.

* For the most part, operation of existing and future plants at current permit levels will result in attainment of "fishable/swimmable" water quality during dry weather conditions: ACTIVELY PROMOTE PROPER OPERATION AND MAINTENANCE OF WASTEWATER TREATMENT FACILITIES.

* The preferred approach for progressing toward attainment of clean water goals builds on coordination of existing authorities, economic incentives and sharing of technical expertise: CONTINUE ACTIVE STATE ROLE IN WASTE TREATMENT MANAGEMENT AND ESTABLISH A LOCAL "WATER QUALITY COUNCIL" WITH A CHARTER TO (1) OVERSEE UP-DATE/IMPLEMENTATION OF 208 PROGRAM; (2) SPEARHEAD NONPOINT SOURCE POLLUTION CONTROL EFFORTS; and (3) PROVIDE INPUT TO FEDERAL/STATE AGENCIES ON ACTIONS RELATED TO WATER QUALITY.

* A limited amount of reliable data exists for substantiating the impact of pollutants coming from nonpoint sources: ASSIGN HIGH PRIORITY TO IMPROVING NONPOINT SOURCE DATA BASE, INCLUDING EFFECTIVENESS OF CONTROLS, AND ENCOURAGE LOCAL GOVERNMENT IMPLEMENTATION OF "BEST MANAGEMENT PRACTICES".

* Specific standards have not yet been formulated to gauge acceptable water quality during stormwater conditions: WORK WITH FEDERAL/STATE AGENCIES TO FORMULATE WET WEATHER WATER QUALITY STANDARDS.

* There is technical merit in addressing water quality problems/actions on a watershed basis: ORGANIZE LOCAL 208 PROGRAM ACCORDING TO THREE PRIMARY WATERSHEDS (1) SPRING CREEK/CYPRESS CREEK/LAKE HOUSTON, (2) CLEAR CREEK/CLEAR LAKE/DICKINSON BAYOU, and (3) HOUSTON SHIP CHANNEL AND TRIBUTARIES. CONSIDER EXPANSION OF DESIGNATED 208 PLANNING AREA TO COMPRISE ENTIRETY OF SAN JACINTO WATERSHED.

Spring Creek/Cypress Creek/Lake Houston

* Subject to the limitations cited above, Spring Creek and Lake Houston will meet "fishable/swimmable" goal in 1995 during both dry and wet weather conditions at existing levels of treatment.

* Cypress Creek evidences a water quality problem during low flow conditions but not during wet weather. MAJOR EFFORTS SHOULD BE FOCUSED ON (1) WATER QUALITY IMPACT OF MATERIALS DEPOSITED ON STREAM BOTTOM (BENTHIC LOAD), (2) TOUGH ENFORCEMENT OF PERMIT CONDITIONS, and (3) CONTINUING ATTEMPTS TO IMPLEMENT JOINT TREATMENT FACILITIES SUPPORTED BY ECONOMIC INCENTIVES.

* CLOSELY MONITOR POPULATION GROWTH AND DISTRIBUTION IN THIS WATERSHED.

* CONSIDER EXPANSION OF DESIGNATED 208 PLANNING AREA TO INCLUDE OTHER STREAMS ENTERING LAKE HOUSTON (EAST AND WEST FORKS OF SAN JACINTO RIVER, LUCE BAYOU).

Clear Creek/Clear Lake/Dickinson Bayou

* Water quality problems exist in this urbanized watershed during both dry and wet weather conditions.

RECOMMENDATIONS OF THIS PROGRAM?

* Clear Creek (nontidal) will not meet "fishable/swimmable" at existing, restrictive permit levels: EVALUATE FEASIBILITY OF TRANSPORTING SELECTED DISCHARGES TO HOUSTON SHIP CHANNEL vs. FURTHER UPGRADING OF ALL PLANTS AND LOWERING OF DISSOLVED OXYGEN STANDARD.

* Wet weather conditions in Clear Creek fail to meet "fishable/swimmable" criteria in 1983-1995: VALIDATE WET WEATHER MODEL AND EXAMINE EFFECTIVENESS OF NONPOINT CONTROLS IN TEST AREAS.

* Simplified stream models also indicate potential water quality problems in Armand Bayou and Dickinson Bayou (Tidal) during dry weather (there are no stormwater models): VALIDATE DRY WEATHER MODELS AND INSTITUTE WET WEATHER MONITORING PROGRAM.

* Phosphorous (nutrient) loads to Clear Lake and Galveston Bay from nonpoint sources and tidal action most likely exceed the minimum level needed for algae problems (eutrophication): ELIMINATE PHOSPHOROUS REMOVAL REQUIREMENTS IN MUNICIPAL DISCHARGE PERMITS UNTIL SUCH TIME THAT A EUTROPHICATION STUDY ON CLEAR LAKE DEMONSTRATES TECHNICAL NEED AND COST EFFECTIVENESS.

* Dredging operations, though infrequent, impose a substantial wasteload: PROHIBIT DREDGING OPERATIONS DURING CRITICAL DRY WEATHER CONDITIONS.

* CONSIDER EXPANSION OF DESIGNATED 208 PLANNING AREA TO INCLUDE TEXAS CITY/GALVESTON AREA.

Houston Ship Channel, Lower San Jacinto River, and Bayou Tributaries

* Except for the turning basin and points immediately downstream, water quality in the Houston Ship Channel is projected to meet "fishable/swimmable" goal during dry weather (following completion of improvements, currently underway, to City of Houston treatment system).

* Water quality in all side bays is expected to meet goal during dry weather.

* Unverified stormwater model indicates substantial water quality problems throughout the Ship Channel during wet weather conditions; dissolved oxygen drops to zero for a period of days; calculations do not correlate with recent observations (i.e., lack of fish kills): INSTITUTE A WET WEATHER MONITORING PROGRAM TO DETERMINE ACTUAL CONDITION OF CHANNEL DURING STORMS PRIOR TO RECOMMENDING FURTHER SPECIFIC ACTION ON STANDARDS, MODELS, OR CONTROLS.

* Supplemental in-stream aeration offers potential for low cost attainment of "fishable/swimmable" goal in upper reaches of channel (dry weather): EVALUATE IN-STREAM AERATION AND MAKE DECISION REGARDING COMPLETE IMPLEMENTATION FOLLOWING RESULTS OF WET WEATHER STUDIES.

* Quality of the Lower San Jacinto River (tidal) dominated by the Houston Ship Channel and impacted by dredging activities: PROHIBIT DREDGING IN LOWER SAN JACINTO RIVER DURING CRITICAL DRY WEATHER CONDITIONS.

* CLASSIFY BUFFALO BAYOU FOR NON-CONTACT RECREATION USE BETWEEN TURNING BASIN AND ADDICKS/BARKER DAMS. LAUNCH PROGRAM TO DETERMINE DRY/WET WEATHER QUALITY AND STANDARDS TO MEET INTENDED USE, INCLUDING PRESERVATION OF BAYOU AESTHETICS.

* FOR ALL OTHER BAYOUS, CONCENTRATE EFFORTS ON PERMIT COMPLIANCE AND KEEPING BACTERIAL COUNTS AT SAFE LEVELS.

* CONSIDER EXPANSION OF DESIGNATED 208 PLANNING AREA TO INCLUDE CEDAR BAYOU WATERSHED.

BEFORE WE GO ANY FURTHER...SOME BACKGROUND ON TECHNICAL PLANNING

This section of the summary report is intended to provide background information to assist in understanding the detailed technical plans which follow. It briefly describes the basic concepts and definitions involved in water quality management.

STANDARDS

Standards are the numerical values by which we measure water quality -- both water in the stream and water to be discharged into the stream. The standards referenced in this report relate to attaining the 1983 "fishable/swimmable" goal. In that regard, two important measures of water quality are dissolved oxygen (DO) and fecal coliform bacteria. The amount of dissolved oxygen present in the stream is important to fish life; a minimum DO concentration of 4-5 mg/1 is considered the standard for maintaining a varied fish population. Fecal coliform bacteria are indicators of human waste and therefore affect "swimmability". Water to be used for human contact has a recommended standard of a maximum 200 MPN (Most Probable Number) of fecal coliforms. For a more complete discussion of water quality standards, refer to an earlier H-GAC 208 publication entitled How Clean Do You Want Your Streams?

POLLUTANTS

Pollutants discharged into streams and lakes impair the attainment of water quality standards. Organic materials require oxygen from the stream for decomposition, reducing the amount available for fish life.

BOD

A common laboratory measure of these organic materials is biochemical oxygen demand (BOD). A BOD of 20 mg/l or less is the general standard for discharges to streams. In the Houston area, however, a more restrictive level (10 mg/l) is the general requirement.

TSS

Certain amounts of soil, plant materials and accumulated dust wash into streams and settle to the bottom or remain suspended. Solids in suspension (Total Suspended Solids, TSS) cause water to be cloudy.

BENTHAL LOAD

Solids which settle to the bottom can smother bottom dwelling organisms and remove oxygen from the stream. This oxygen demand is referred to as benthal load.

NUTRIENTS

Nutrients, such as nitrogen and phosphorous, are fertilizer type materials which are essential to plant life. However, excessive quantities of nutrients can cause overproduction of aquatic plants. This phenomenon, commonly referred to as eutrophication, is aesthetically displeasing and also imposes an oxygen demand.

CHLORINE

Chlorine is a widely used disinfectant in waste treatment plants for reducing bacteria. In heavy concentrations, however, chlorine is toxic and can be poisonous to fish as well as harmful to people.

SOURCES

Point sources of pollution are (typically) those which emit from municipal and industrial wastewater treatment plants. Nonpoint sources are generalized discharges of waste into a water body which cannot be located as to a specific source; for example, erosion from construction activity, stormwater runoff and improperly sited septic tanks.

POINT

NONPOINT

CRITICAL CONDITIONS

DRY WEATHER

As has been mentioned, streams and lakes have a limited natural ability to cleanse themselves of waste materials. That ability varies with weather conditions and stream characteristics. In dry weather conditions (low flow) point sources are the dominant pollutant concern, although nonpoint sources still contribute from septic tanks, dredging activities and benthic deposits. In fact, some streams in the Houston area are composed primarily of treatment plant discharges in dry weather (effluent dominated).

WET WEATHER

During wet weather conditions, nonpoint sources of pollution become predominant as falling rain washes debris, animal wastes, fertilizer, oil, and grease into streams. Point source problems during rain events stem from greater amounts of water entering treatment plants as a result of sewer pipe leakages and improper connections. The sewage treatment plant can be strained beyond its maximum capacity to adequately treat wastewater.

It is important to note that our current standards relate to dry weather conditions which occur on the average of a seven-day period every two years (7 day, 2 year, low flow).

Wet weather conditions present a complex situation for standard setting as many variables are involved -- intensity, duration and amount of rainfall, length of time since last rain, size of drainage area, and specific stream characteristics all affect the resulting condition of the stream.

MODELS

The technique used to study the likely reaction of streams to different conditions is called modeling. Quite simply, this involves simulating or imitating the responses of the stream by the use of mathematical formulas, most often with the assistance of computers.

In other words, the scientist uses simulation models in an attempt to reproduce under test conditions events that are likely to occur under actual conditions.

Most of the models presently available for water quality planning are for dry weather conditions and relate particularly to point sources. These are used with some confidence as dry weather conditions are relatively unchanging (steady state). It is therefore less difficult to obtain that information needed to compare actual field conditions with mathematical results. Where field measurements compare closely with mathematical calculations, the model is said to be calibrated and verified.

Due to the complexities of wet weather conditions, models for wet weather (nonsteady state) are still at an early stage of development and lack field verification. That should be kept in mind when considering the results of the 208 study.

CONTROLS

PERMITS

Pollutant wasteloads must be controlled to protect water quality. Controls are applied to protect the stream under all conditions; however, the extent of these controls depends on critical conditions. The major control technique is through the issuance of discharge permits. These permits issued by the Texas Department of Water Resources and the Environmental Protection Agency set limits to the amount of pollutants that may be discharged. Permits most frequently address measurements of BOD, TSS, and nutrients. Permit requirements presently in use by the Texas Department of Water Resources for various levels of restriction (effluent sets) are shown in the following table.

TDWR EFFLUENT SETS

Effluent Set	Level of Treatment				Treatment Process Corresponding to Effluent Set
	BOD	TSS	NH_3-N	P*	
0	30	30	-	-	Oxidation Ponds
1	20	20	-	-	Secondary (conventional design)
2	10	15	-	-	Modified secondary (enhanced solids separation)
3	5	10	-	-	Set 2 with chemical addition
4	5	5	-	-	Set 3 with filters
2N	10	15	5	-	Set 2 with biological nitrification
3N	5	10	5	-	Set 3 with biological nitrification
4N	5	5	3	-	Set 4 with biological nitrification
3P	5	10	-	2	Chemical addition in biological process
4P	5	5	-	1	Chemical precipitation after biological process

"NH_3-N" stands for ammonia-nitrogen which imposes an oxygen demand.

"P" stands for Phosphorous which is a nutrient.

Two basic approaches can be taken to reduce the amount of pollutants and to meet permit requirements: structural and nonstructural.

STRUCTURAL

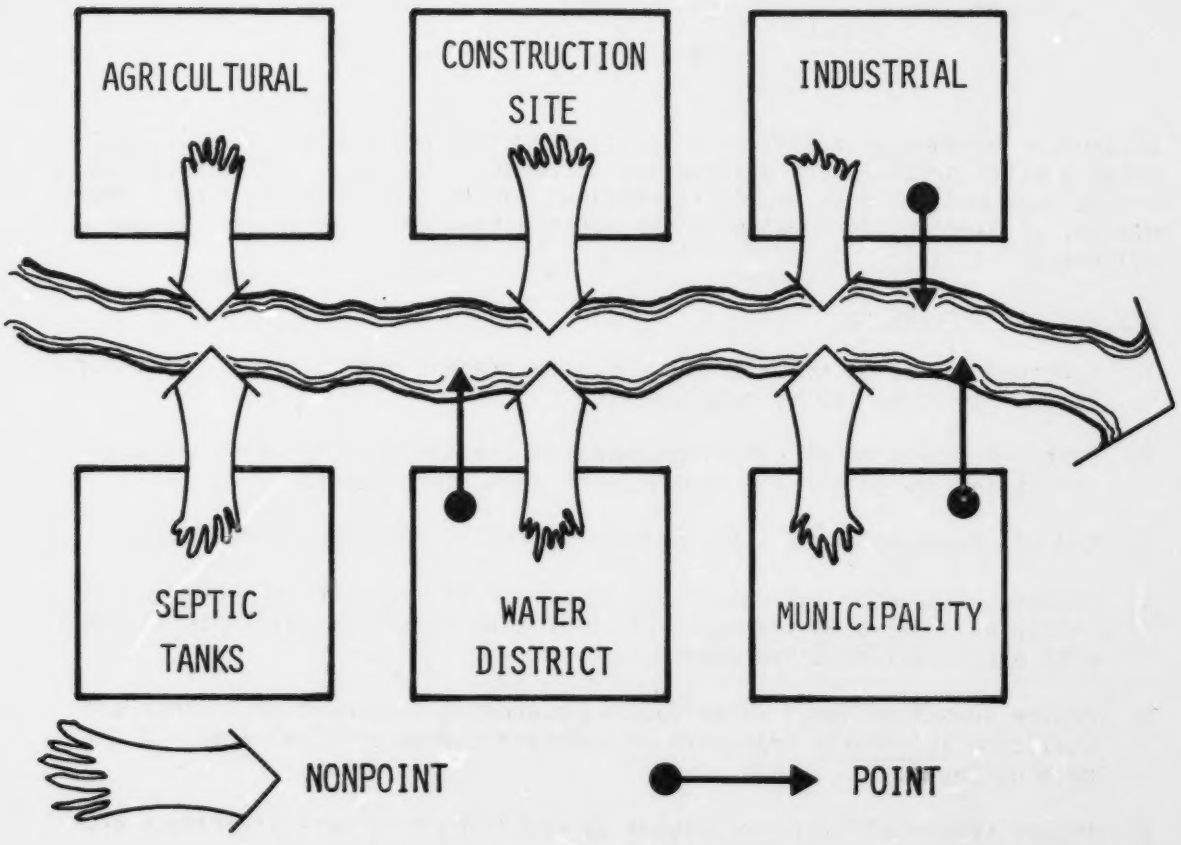
Structural controls for point sources are characterized by sewerage facilities; i.e., treatment plants, collection lines, pumps, sludge disposal. Structural controls for wet weather nonpoint sources could consist of such things as retention ponds, treatment plants, and land drainage modifications.

NONSTRUCTURAL

Nonstructural controls involve no major construction or alteration to land. For point sources such controls are aimed at reducing the amount of wastewater requiring treatment and improving the quality of water before treatment. Examples of such programs include water conservation and reuse, bans on phosphorous detergents, and frequent inspections of sewer lines.

For nonpoint sources, controls are aimed at eliminating the problem at its origin. Septic tank ordinances and regulation of dredging could assist in reducing dry weather nonpoint pollutants. Examples of nonstructural controls to improve water quality during rainfall include street sweeping, anti-litter ordinances, erosion control, greenbelt buffer zones, and restrictions on use of fertilizers and pesticides/herbicides. Nonstructural controls are not capital intensive but are more dependent on regulation and administration -- these programs are sometimes referred to as Best Management Practices (BMP).

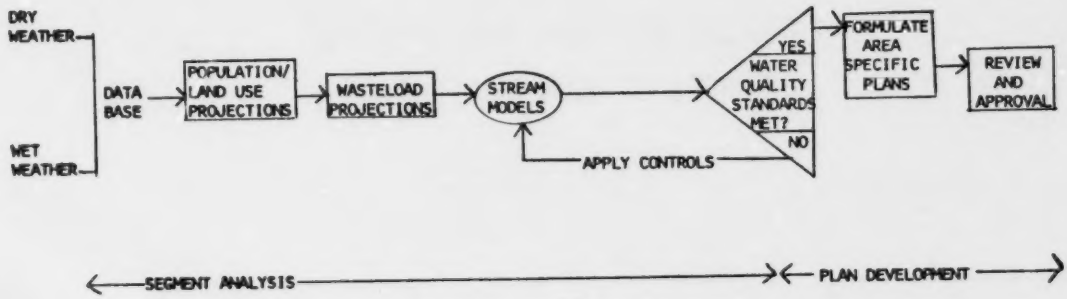
EXAMPLES OF POINT AND NONPOINT
SOURCES OF WATER POLLUTION



HOW WERE THE TECHNICAL SUBPLANS DEVELOPED?

The previous section discussed types of pollutants, standards for pollutant discharge, differing conditions, controls and modeling. The technical subplans look at streams in segments, analyze potential problems and propose possible solutions in order to protect the quality of the water.

The diagram below presents the steps in the technical subplanning process. These steps are performed separately for each stream segment where models are available. The segment analysis determines critical areas of the stream, types of wasteloads to be controlled, and approximate levels of controls. The technical subplan utilizes the segment analysis information and develops specific groups of strategies to obtain the stated water quality objectives.



Wastewater management practices (strategies) which are capable of solving the water quality problems are defined and screened. The least suitable practices are deleted and the most promising retained for further investigation. Basic strategies examined in developing the Houston Area 208 Program include the following:

Dry Weather Strategies

1. Continue operation of existing plants at present permit levels. New population served by septic tank systems.

2. Continue operation of existing plants at present permit levels and construct any new plants for operation at those same levels.

3. Reduce sewage effluent wasteloads by upgrading treatment efficiency.

4. Reduce sewage effluent wasteloads by upgrading treatment efficiency and utilizing intrabasin transport of wasteloads from critical areas to areas with excess assimilative capacity.

5. Reduce sewage effluent wasteloads by upgrading treatment efficiency and utilizing interbasin transport of wasteloads from critical areas to the neighboring basin.

6. Reduce sewage effluent wasteloads by upgrading treatment efficiency and utilizing land disposal of wasteloads from critical areas.

The strategies that were accepted for further study on each segment were also evaluated in terms of three regionalization concepts.

Regionalization Alternatives

Concept A assumes that sewage treatment systems will develop to serve special population clusters such as new subdivisions, with little or no consideration of the treatment needs or excess capacity in neighboring treatment systems. Concept A is the nonregional concept of sewage treatment.

Concept B assumes that certain geographical planning areas are grouped together and larger sewage treatment systems are developed to serve this broader population base. The result is fewer treatment plants, less unused capacity, but higher costs for transporting sewage. Concept B is the semi-regional concept of sewage treatment.

Concept C is a fully regional concept. It assumes a grouping of the semi-regional facilities defined for Concept B. This results in larger and fewer treatment systems than the semi-regional concept.

The various strategies, particularly those involving regionalization were analyzed according to geographical areas in the watershed. These areas were defined on the basis of stream problem areas, logical grouping of existing service areas, land use patterns, existing facilities, and facility plans. These areas were developed to subdivide the drainage basin for planning purposes and are presented only as a frame of reference. Maps of these geographical planning areas are included in the detailed text of the technical plans (Alternative Technical Subplans Report). This summary report concentrates on the findings and recommendations for the streams as a whole.

Wet Weather Strategies

Many types of nonpoint source control strategies are available for reducing the impact of urban runoff. An inventory of the various strategies, both structural and nonstructural, is included in the Nonpoint Source Analysis Report for the Greater Houston Area 208 Program.

Many factors must be considered in the selection of a suitable control. The Nonpoint Source Analysis Report concluded that vegetative control techniques are the most favorable method for upgrading urban runoff in the 208 area. Small scale retention is ranked as the second most suitable category of control strategies for urban runoff. These techniques (in combination with overall encouragement of "best management practices") received preferable attention in the development of recommended strategies.

Large scale, structural approaches to runoff control were de-emphasized in the technical work. Such techniques generally are expensive, require large commitments of resources, and are difficult to implement and maintain.

WHAT ABOUT COSTS?

Costs used in developing and evaluating technical subplan alternatives were made on the basis of a term called "Present Worth". This assumes that all future expenditures (capital plus operations and maintenance) take place at the present time. It does not take inflation and many other variables into account. "Present Worth" costs for the Houston Area 208 program were developed on the basis of 1975 dollar values.

As indicated by the above definition, "Present Worth" does not present a true measure of actual projected treatment costs. However, since all costs (for technical subplans) are developed on the same basis, trade-off's between alternatives can still be made. It can serve as a technique for evaluating technical alternatives on an equivalent basis and is the method required by EPA in costing evaluations.

The "Present Worth" value can also demonstrate the gross economic impacts of implementing various strategies (costs significantly higher/costs of various alternatives about the same/potential cost savings by pursuing particular course of action).

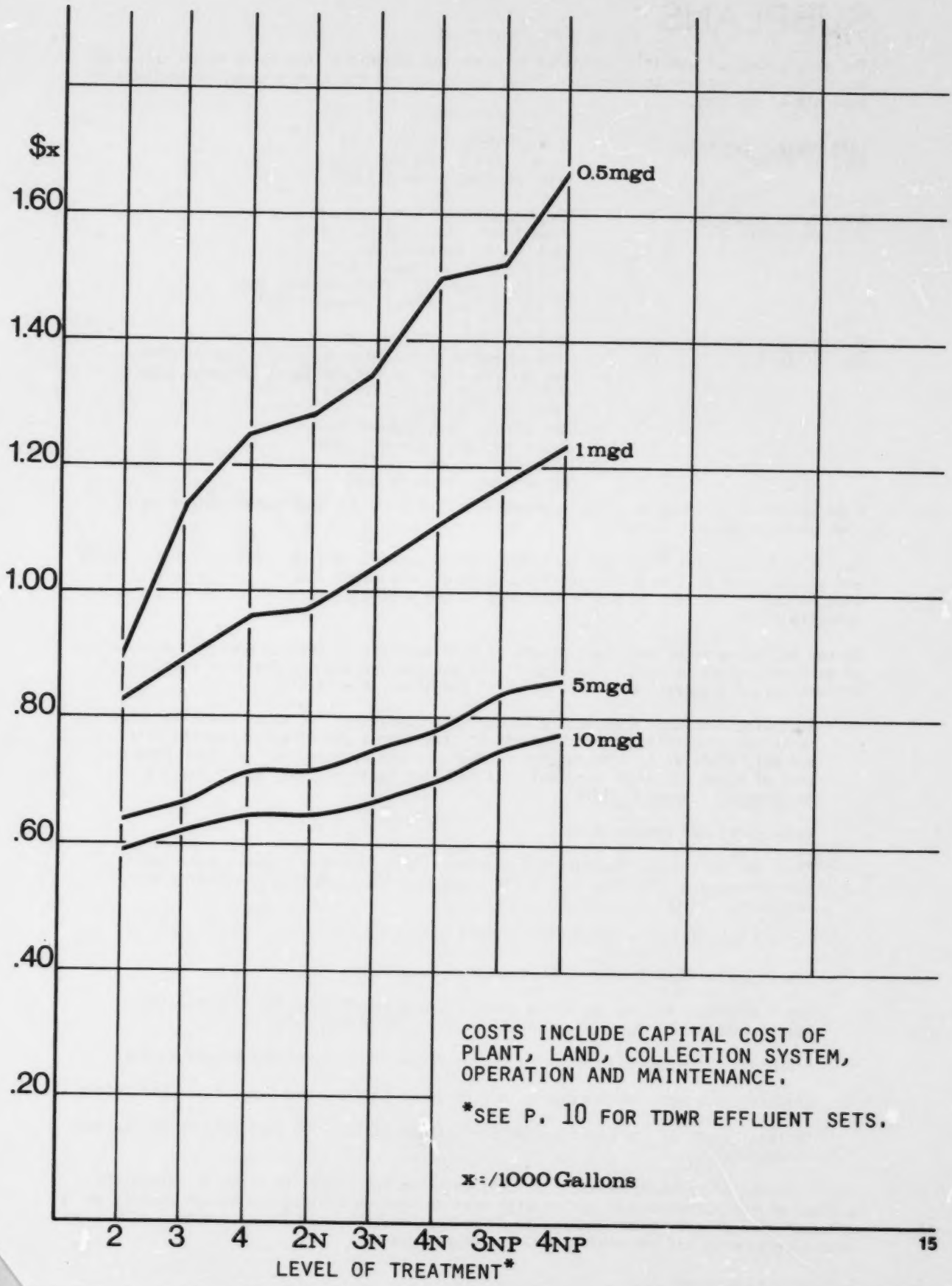
It is emphasized that the "Present Worth" figure does not represent an anticipated user charge. As mentioned, the value does not include inflation. There are also many other variables which enter into the actual cost that a homeowner will eventually pay. These include such things as:

- Who the operator is.
- What bond rate applies.
- How much Federal funding assistance is received (Public Law 92-500, Section 201, Construction Grants Program).
- Age of treatment system, amount of bonded indebtedness, and requirements for upgrading.
- What the land and energy requirements are.
- Portion of costs paid by industrial dischargers to treatment system.
- Size of service area.

Such factors can be addressed only on a service area basis as specific facility plans are developed. Attempts to precisely determine such costs cannot be accurately calculated in an areawide planning program such as 208. In fact, any attempts to do so would be misleading. That notwithstanding, some average values can be shown to demonstrate the impact on treatment costs for various circumstances. The chart on the following page shows how costs vary with required level of treatment and plant size.

The chart also shows that cost advantages can be gained by going to larger facilities. This is particularly the case where restrictive permit levels apply. Consolidation of individual treatment facilities to capture the benefits of economies of scale can be accomplished through regionalization. The timing of development is critical to the economic feasibility of regionalization; it is necessary to have sufficient population to share the cost of developing larger facilities and can be prohibitive to transport waste over large vacant areas. Such projects, therefore, require repeated economic analysis to determine the net impact of consolidation. This can only be done with any degree of accuracy on a case-by-case basis. The management system resulting from the 208 Program must allow for such analyses.

COMPARATIVE COSTS FOR VARIOUS LEVELS OF WASTE TREATMENT BY PLANT SIZE



COSTS INCLUDE CAPITAL COST OF PLANT, LAND, COLLECTION SYSTEM, OPERATION AND MAINTENANCE.

*SEE P. 10 FOR TDWR EFFLUENT SETS.

x=/1000 Gallons

INTRODUCTION TO SPECIFIC TECHNICAL SUBPLANS

The development of specific technical subplans was organized into three major subbasins according to watershed boundaries. These subbasins and the stream segments included in each are as follows:

Lake Houston Subbasin: (pp. 18 to 24)	Spring Creek, Segment 1008 Cypress Creek, Segment 1009 Lake Houston, Segment 1002
Clear Lake Subbasin: (pp. 19 to 39)	Clear Creek Nontidal, Segment 1102 Clear Creek Tidal, Segment 1101 Clear Lake, Segment 2425 Armand Bayou, Unclassified* Dickinson Bayou Nontidal, Segment 1104 Dickinson Bayou Tidal, Segment 1103
Houston Ship Channel Subbasin: (pp. 40 to 47)	Turning Basin, Segment 1007 Turning Basin to San Jacinto River, Segment 1006 San Jacinto River to Morgans Point, Segment 1005 Buffalo Bayou, Unclassified* Tabbs Bay, Segment 2426 San Jacinto Bay, Segment 2427 Black Duck Bay, Segment 2428 Scott Bay, Segment 2429 Burnett Bay, Segment 2430

* Unclassified segments have not received detailed study by TDWR and therefore have no assigned segment number.

This organization, in the order outlined above, parallels the detailed technical reports and groups areas of common characteristics (e.g., drainage). Also, this organization lends itself to conducting public hearings in the area most affected by findings/recommendations.

On the following pages are descriptions of each subbasin as well as specific discussions of each individual segment. The segment discussions include the drainage area, major tributaries, and general characteristics of the area, as well as:

Statewide Ranking - A procedure of the Texas Department of Water Resources that ranks all classified stream segments in ascending order of water quality (#1-poorest, #297-best). The ranking methodology can be found in the Texas Department of Water Resources document entitled, The State of Texas Water Quality Management Program, FY 1978.

Major Permitted Dischargers.

Flows and wasteloads entering the segment. 1975 figures represent existing conditions, and 1995 figures are the projected flows and loads, assuming permit levels will be met.

Current permit levels within the segment watershed.

Specific findings for dry and wet weather conditions.

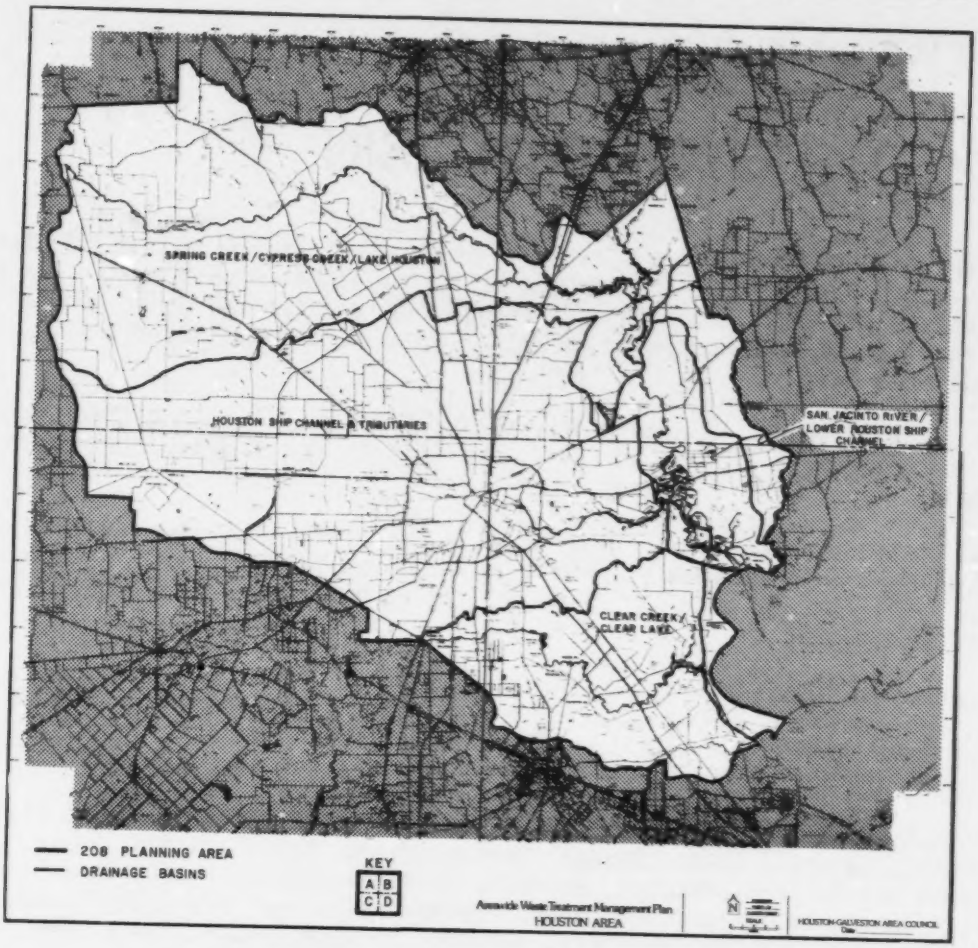
Major alternatives considered to achieve the goal of fishable/swimmable (dissolved oxygen of 5 mg/l, fecal coliform of <200 MPN/100 ml).

Dissolved oxygen profiles showing stream response to oxygen demand wasteloads.

Specific recommendations based on the findings from dry and wet weather conditions.

Costs: potential increases and/or savings associated with implementing the various recommendations.

The inclusion of technical details at this point in the report is meant to stress the actions which the management system will have to take to achieve the stream quality goals selected through the review and public participation process. The description of management alternatives and recommendations begins on Page 48.



STREAM SEGMENT	1977 STATEWIDE RANKING	FISH KILLS REPORTED (9/74-11/77)*	WATER QUALITY MODELS DRY		WET
1008 Spring Creek	30	none	Qual II	Calibrated WRECEV Unverified	Uncalibrated Unverified
1009 Cypress Creek	12	none	Qual II	Calibrated WRECEV Unverified	Uncalibrated Unverified
1002 Lake Houston	58	none	Mass Balance	Calculations	none
1101 Clear Creek Tidal	57	3	EPA Simplified	Nonspecific	none
1102 Clear Creek Nontidal	8	none	Qual II	Calibrated WRECEV Unverified	none Uncalibrated Unverified
2425 Clear Lake	90	4	EPA Simplified	Nonspecific	none
1103 Dickinson Bayou Tidal	29	3	EPA Simplified	Nonspecific	none
1104 Dickinson Bayou Nontidal	17	none	SAC III	Nonspecific	none
1001 San Jacinto River	56	none	Auto SS	Calibrated WRECEV Unverified	Uncalibrated Unverified
1005 Houston Ship Channel Morgans Point to San Jacinto River	61	2	O'Connor-Hydroscience	Calibrated WRECEV Verified	Uncalibrated Unverified
1006 Houston Ship Channel San Jacinto River to Turning Basin	2	8	O'Connor-Hydroscience	Calibrated WRECEV Verified	Uncalibrated Unverified
1007 Houston Ship Channel Turning Basin	1	3	O'Connor-Hydroscience	Calibrated WRECEV Verified	Uncalibrated Unverified

*TDWR records on file at District 7 Office, Deer Park.

LAKE HOUSTON SUBBASIN

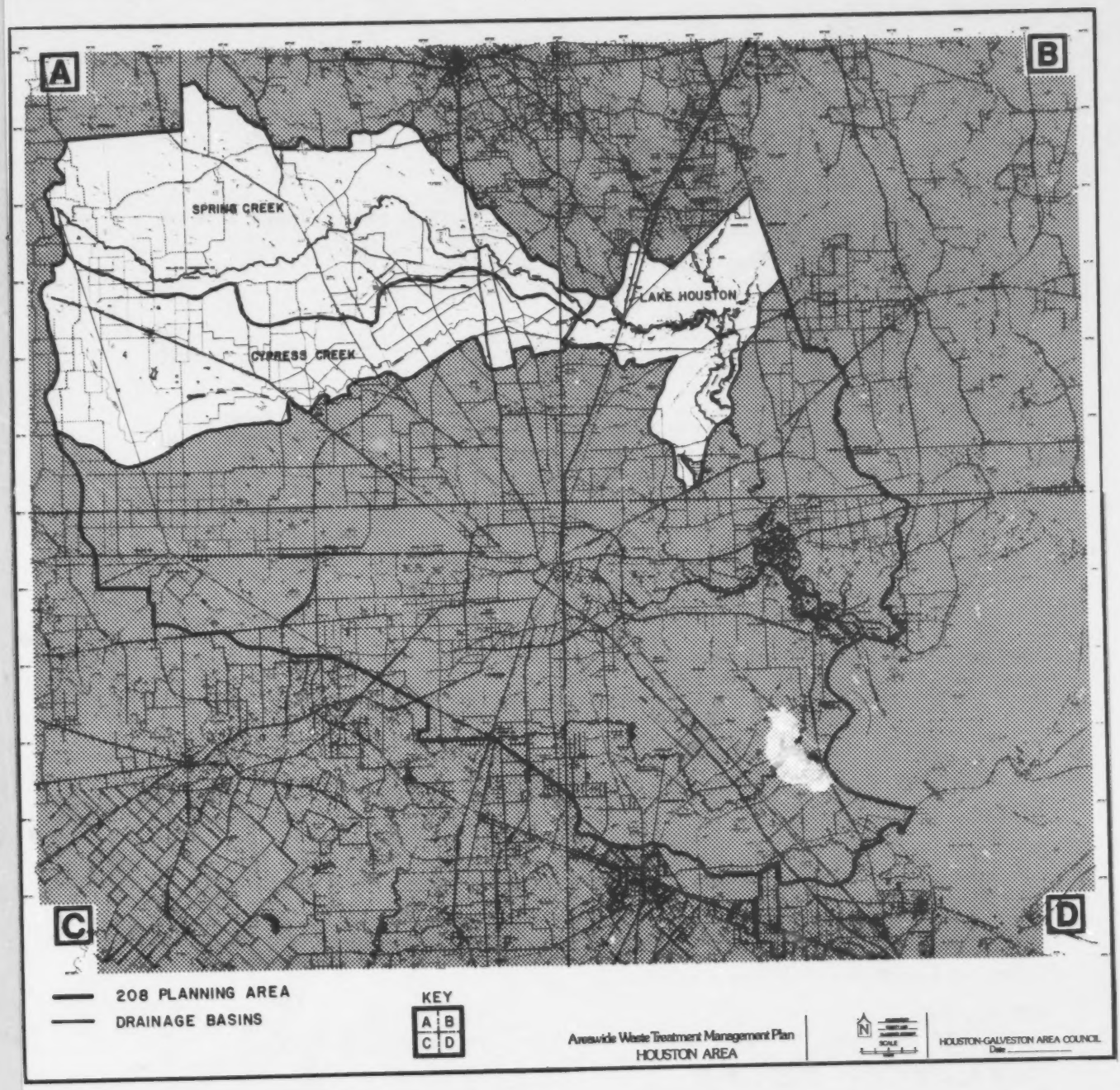
The Lake Houston Subbasin is located in the northern third of the 208 planning area. Much of Houston's rapid growth is taking place in this area. The major waterways within this subbasin are Spring Creek and Cypress Creek, which combine and flow to Lake Houston. The lake serves as a major water supply and recreation area.

Soils in this subbasin are generally sandy, loamy in the Spring Creek watershed, becoming more clayey and poorly draining in the southern portion of the subbasin.

Normal annual precipitation ranges from 46 inches to 48 inches, while temperature ranges from a minimum monthly normal (January) of 51^{o}F to a maximum monthly normal (July-August) of 83.5^{o}F. Prevailing wind is from the south-southeast 12 months of the year.

Vegetation north of Spring Creek is pine-hardwood forest including Post, Blackjack, and Southern Red Oaks, Loblolly Pine, and Mockernut Hickory. South of Spring Creek begins the Bluesteam Prairie, an area of dense to open grasslands including Big and Little Blue Stem, Switch grass, and Indian grass.

Principal birdlife in this subbasin include Bobwhite Quail, Mourning Dove, Common Snipe, Sandhill Crane, Canada, Lesser Canada, Snow, and Blue Geese. Also to be found are Mallard, Mottled, Godwall, American Widgeon, Teal, Shoveler, Canvasback, Redhead, and Ringnecked Ducks. White-tailed deer are to be found, as well as Eastern Grey and Fox Squirrels, raccoon, opossum, skunk, Swamp Rabbit, and several species of turtles, toads, salamanders, lizards, and snakes.


A
B
C
D
SPRING CREEK
CYPRESS CREEK
LAKE HOUSTON
208 PLANNING AREA
DRAINAGE BASINS
KEY
A B
C D
Areawide Waste Treatment Management Plan
HOUSTON AREA
N
SCALE
HOUSTON-GALVESTON AREA COUNCIL
Date

SPRING CREEK (SEGMENT 1008)

WATERSHED/SEGMENT DESCRIPTION:

Headwaters in northeast Waller County, flows eastward to its confluence with the West Fork of the San Jacinto River and Lake Houston (68 miles).

AREA: 438 square miles.

MAJOR TRIBUTARIES: Willow Creek, Panther Branch, Mill Creek, Walnut Creek, Cypress Creek.

CHARACTERISTICS: Historically rural and agricultural; rapidly developing urban/suburban area with major growth at Woodlands, near City of Magnolia, and along Creek.

STATEWIDE RANKINGS: 1976 25 1977 30

MAJOR PERMITTED DISCHARGES: MUNICIPAL 11 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	1.9	8.5	116	710
INDUSTRIAL	---	---	---	---

CURRENT MUNICIPAL PERMIT:

Woodlands: 5 mg/l BOD
5 mg/l TSS
2 mg/l P
(monthly average)

All Others: 10 mg/l BOD
15 mg/l TSS
(monthly average)

FINDINGS:

DRY WEATHER
- Will meet goal of fishable/swimmable quality at existing permit levels with proper operation and maintenance.
- D.O. levels in stream extremely sensitive to NH_3-N discharges of concentrations greater than 8 mg/l.
- Anticipated water quality will produce no detrimental effects in Lake Houston.
- Nonpoint source wasteloads not a significant problem.

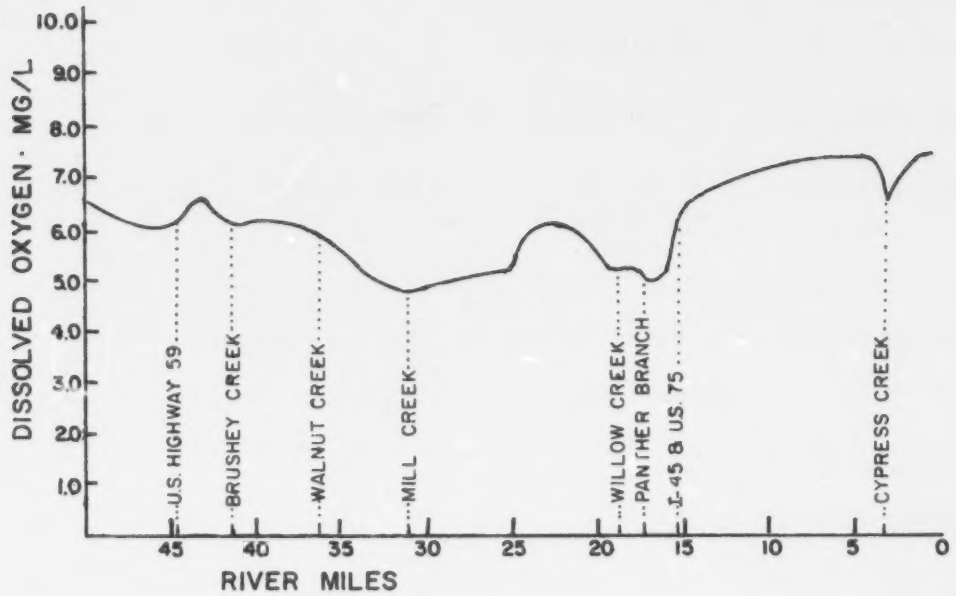
WET WEATHER
- Unverified stormwater model predicts conformance with dry weather standards.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION	COMMENT
- Operation of existing and future facilities at current permitted levels with no regionalization.	- Meets fishable/swimmable.
- Operation of existing and future facilities at current permitted levels with regionalization.	- Localized D.O. problems caused by major discharges.

SPRING CREEK (SEGMENT 1008)

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER
- Operate existing and future wastewater treatment facilities at existing permit levels.
- Keep alert to regional wastewater treatment opportunities if warranted by future population patterns.
- Implement monitoring program to update and verify dry weather model.
- Consider adopting effluent standard of 8 mg/1 of NH_3-N for use in permits where more restrictive levels do not presently apply.
- Maximum limits on chlorine residual in plant effluents should be considered by Texas Department of Water Resources.

WET WEATHER
- Implement monitoring program to update and verify wet weather model.
- Formulate wet weather standards consistent with fishable/swimmable goal.
- Encourage use of best management practices to reduce amount of pollutants washed to stream.

COSTS:

- Those necessary to meet existing permit levels.
- Potential increased costs for NH_3-N reduction and chlorination control.
- Sampling and analytical work to update and verify models.

CYPRESS CREEK (SEGMENT 1009)

WATERSHED/SEGMENT DESCRIPTION:

Major tributary of Spring Creek and Lake Houston. Originating in Waller County flowing easterly (58 miles) to its confluence with Spring Creek, 6 miles upstream of Lake Houston.

AREA: 322 square miles.

MAJOR TRIBUTARIES: Little Cypress Creek, Mound Creek, Snake Creek.

CHARACTERISTICS: Historically rural, rapidly developing suburban-residential area with major growth along the Creek from FM 290 eastward.

STATEWIDE RANKINGS: 1976 10 1977 12

MAJOR PERMITTED DISCHARGES: MUNICIPAL 27 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	3.7	12.1	243	519
INDUSTRIAL	---	---	---	---

CURRENT MUNICIPAL PERMIT:
10 mg/l BOD, 15 mg/l TSS, 5 mg/l NH_3-N as monthly averages (effluent set 2N).

FINDINGS:

DRY WEATHER
- Dissolved oxygen levels projected to fall below goal of fishable/swimmable quality.
- Fecal coliform levels projected to meet goal of fishable/swimmable quality.
- Nonpoint source wasteloads in the form of benthic oxygen demand are a major problem in the lower portion of the Creek.
- At a minimum, benthal loads must be reduced by 2/3 to meet water quality standards.
- Nutrients do not present a problem in this segment.
- D.O. levels as low as 3.0 mg/l and BOD levels of 10 mg/l at the mouth of Cypress Creek have no adverse effect upon Spring Creek or Lake Houston.

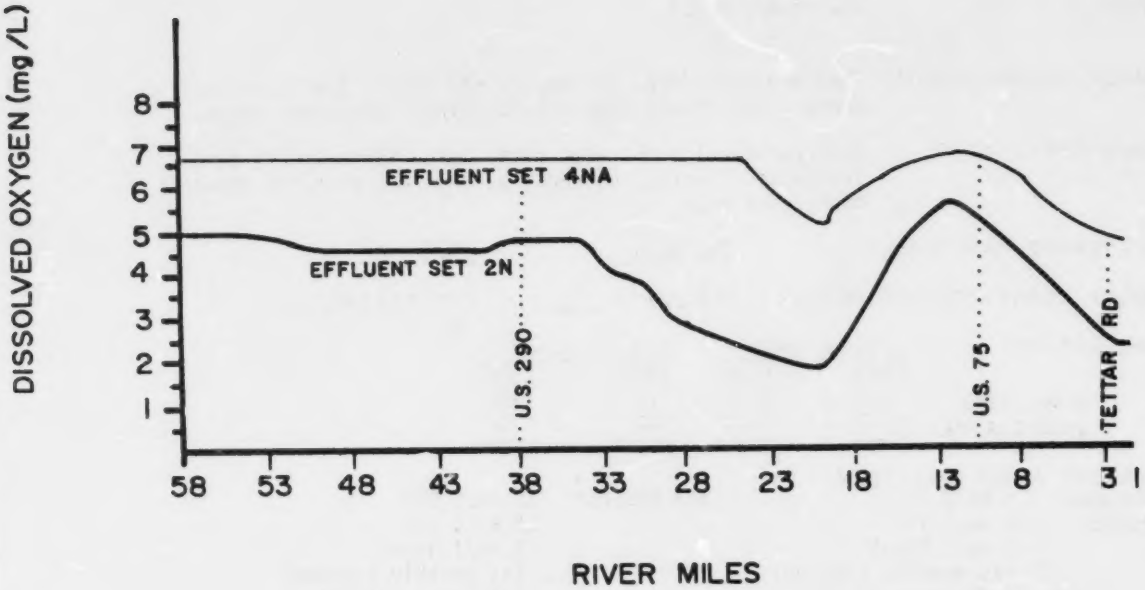
WET WEATHER
- Unverified stormwater model predicts conformance with dry weather standards.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION	COMMENT
- Operate existing and future facilities at current permit levels.	- Does not meet fishable/swimmable.
- Upgrade treatment efficiency to 5 mg/l BOD, 5 mg/l TSS, 3 mg/l NH_3-N plus post-aeration (4NA).	- With 2/3 reduction of benthal load meets fishable/swimmable.
- Transport certain plant effluents at Level 2 (10 mg/l BOD, 15 mg/l TSS) to Greens Bayou; upgrade remaining plants to 4NA).	- Meets fishable swimmable with 2/3 reduction of benthal load. Potential savings of $2 million as compared to all plants at 4NA.

CYPRESS CREEK (SEGMENT 1009)

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER
- Operate existing and future wastewater treatment facilities at current permit levels pending outcome of benthal load studies.
- Construct future facilities with provisions to meet 4NA requirement.
- Actively pursue opportunities for regional wastewater treatment.
- Initiate field studies to assess (1) actual benthal demand along the Creek, (2) relationship between level of sewage treatment and benthal load, and (3) verify steady state model.
- Maximum limits on chlorine residual in plant effluents should be considered by Texas Department of Water Resources.
- Implement strong enforcement policy to ensure permit compliance.

WET WEATHER
- Implement monitoring program to update and verify wet weather model.
- Formulate wet weather standards consistent with fishable/swimmable goal.
- Encourage use of best management practices to reduce amount of pollutants to stream.
- Closely coordinate with flood control projects, particularly as related to water quality impacts and implementation of nonstructural controls.

COSTS:

- Potential cost savings of $13 million (present worth) exist for the development of regional wastewater treatment facilities within this basin over the next 20 years. Actual cost savings can only be determined on an individual service area basis during implementation.
- Potential increased costs for chlorination control.
- Sampling and analytical work to update and verify models.
- Sampling and analytical work related to study of benthal loads.

LAKE HOUSTON (SEGMENT 1002)

WATERSHED/SEGMENT DESCRIPTION:

Located 15 to 20 miles northeast of Houston; serves as a potable water supply reservoir. Also provides water for industrial use, mining, irrigation, and recreational purposes.

AREA: 300 square miles.

MAJOR TRIBUTARIES: East and west forks of San Jacinto River, Spring Creek, Caney Creek, Peach Creek, Luce Bayou, Tarkington Bayou.

CHARACTERISTICS: Suburban development around the Lake, historically not extensive. Increasing rapidly, however, with the growth of Houston area.

STATEWIDE RANKINGS: 1976 65 1977 58

MAJOR PERMITTED DISCHARGES: MUNICIPAL 6 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	0.5	4.17	16	348
INDUSTRIAL	---	----	--	---

CURRENT MUNICIPAL PERMIT:

Kingwood: (HCUD5)
- 5 mg/l BOD
- 10 mg/l TSS
- 5 mg/l NH_3-N
- (as monthly average)
- (effluent set 3N)

All Others*:
- 10 mg/l BOD
- 15 mg/l TSS
- 5 mg/l NH_3-N
- (as monthly average)
- (effluent set 2N)

*Within 5 miles of the Lake

FINDINGS:

DRY WEATHER
- Will meet goal of fishable/swimmable quality at existing permit levels with proper operation and maintenance; fecal coliform concentrations projected to remain less than 20 MPN/100 ml.
- Nonpoint source wasteloads not a signifcant oxygen demand problem.
- Eutrophication may be a problem.
- The above findings are based on population projections which are lower than recent trends suggest.

WET WEATHER
- Phosphorous loads contributed from outside the designated 208 area exceed by nearly 6 times the load at which eutrophication problems could arise and nearly 4 times the load contributed from within the designated 208 area.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION	COMMENT
- Operate existing and future municipal wastewater treatment facilities at current permit levels.	- Meets fishable/swimmable.
- In that portion of watershed within 208 area, upgrade existing municipal facilities and construct future facilities to include phosphorous removal.	- Meets fishable/swimmable; cost/benefit of phosphorous removal in question when compared with nonpoint source nutrient loads.

LAKE HOUSTON (SEGMENT 1002)

DISSOLVED OXYGEN PROFILE

NONE AVAILABLE

RECOMMENDATIONS:

DRY WEATHER
- Operate existing and future municipal wastewater treatment facilities at current permit levels.
- Keep alert to regional wastewater treatment opportunities if warranted by changing population patterns.
- Maximum limits on chlorine residual in plant effluents should be considered by Texas Department of Water Resources.
- Closely monitor and update population projections for the area.

WET WEATHER
- Encourage best management practices to reduce amount of pollutants to Lake.
- Implement eutrophication study to encompass entire Lake Houston watershed.
- Formulate wet weather standards consistent with fishable/swimmable goal.

COSTS:

- Those necessary to meet current permit levels.
- Potential increased costs for chlorination control.
- Sampling and analytical work related to eutrophication study.

CLEAR LAKE SUBBASIN

The Clear Lake Subbasin is located in the southern third of the 208 planning area, southeast of Houston. This area has experienced major development in the past five years and is projected to continue this trend throughout the planning period. The major waterways studied are Clear Creek and Armand Bayou, which drain into Clear Lake (a center of water-related recreational activity), Clear Lake, itself, and Dickinson Bayou, which drains into Dickinson Bay and Galveston Bay.

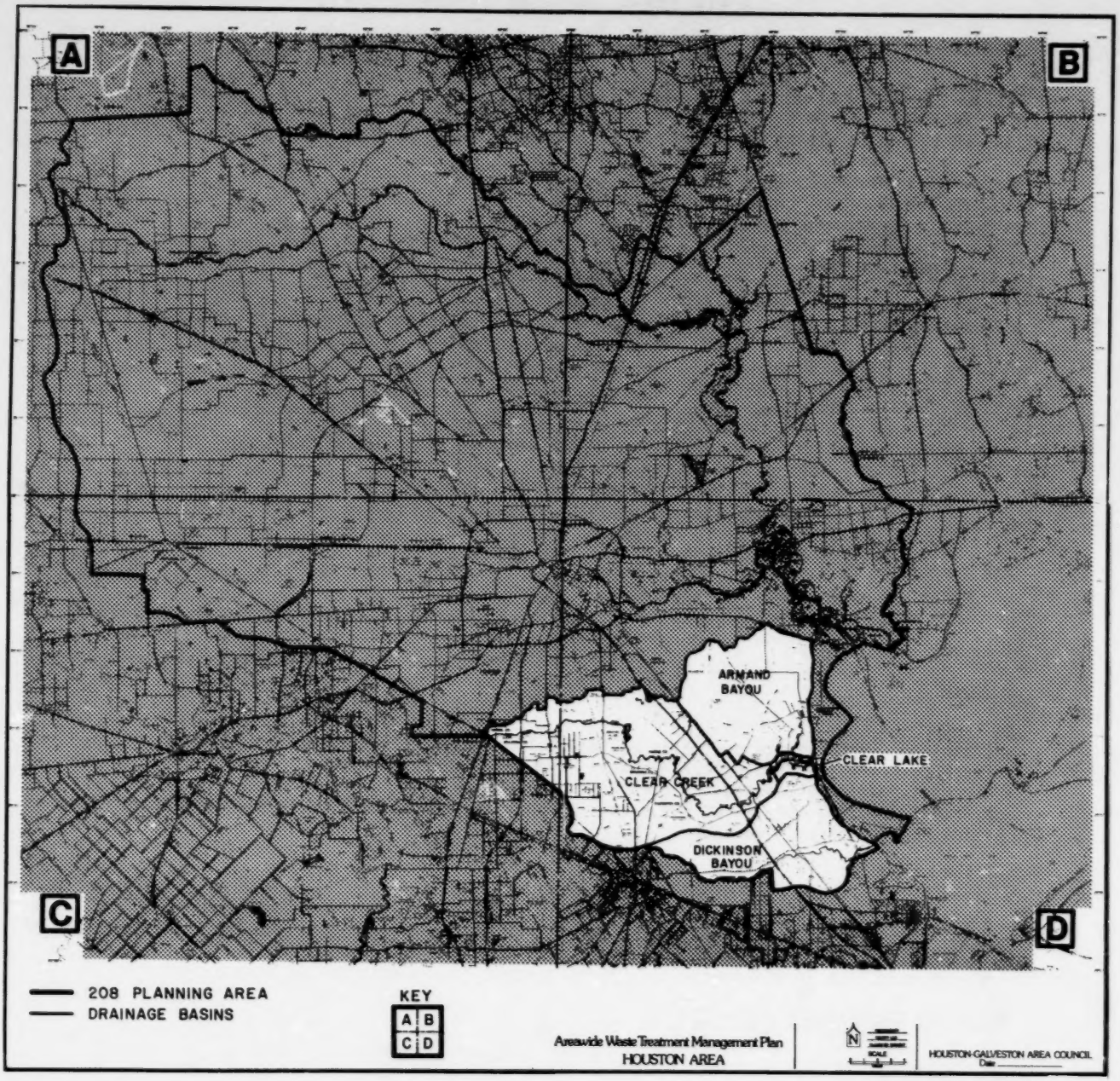
The soils of this subbasin are generally clayey, loamy soils which are slowly permeable and poorly drained. Soils of this type tend to increase the effects of flooding, particularly when one storm event is closely followed by another. Situations of this nature have led to proposals for major flood control efforts by the U.S. Army Corps of Engineers.

This flooding problem is further aggravated by land subsidence. One effect of subsidence is to bring areas into flood plains that once were safe from major flooding.

Normal annual precipitation ranges from 44 inches to 48 inches, while temperature ranges from a minimum monthly normal (January) of 52.5°F to a maximum monthly normal (July-August) of 83.5°F. Prevailing wind is from the south-southeast 12 months of the year.

Vegetation is Bluestem Prairie, a dense to open grassland comprised predominantly of Big and Little Blue Stem, Switch Grass, and Indian Grass.

Principal birdlife of this subbasin include Bobwhite Quail, Mourning Dove, Common Snipe, Sandhill Crane, Canada, Lesser Canada, Snow, and Blue Geese, as as well as Mallard, Mottled, Godwall, American Widgeon, Teal, Shoveler, Canvasback Redhead, and Ringnecked Ducks. Principal mammals include White-tailed Deer, Eastern Grey, and Fox Squirrels, Opossum, Racoon, Skunk, and Swamp Rabbit. There are several species of turtles, toads, lizards, salamanders, and snakes to be found within this subbasin.


A
B
C
D
ARMAND BAYOU
CLEAR LAKE
CLEAR CREEK
DICKINSON BAYOU
208 PLANNING AREA
DRAINAGE BASINS
KEY
A B
C D
Areawide Waste Treatment Management Plan
HOUSTON AREA
HOUSTON-GALVESTON AREA COUNCIL

CLEAR CREEK NONTIDAL (SEGMENT 1102)

WATERSHED/SEGMENT DESCRIPTION:

Headwaters in eastern Ft. Bend County, flows 31 miles to the tidal headwaters at FM 528 in Galveston County; forms the boundary between Harris and Brazoria Counties.

AREA: 120 square miles.

MAJOR TRIBUTARIES: Cowart Creek, Turkey Creek, Mary's Creek, Mud Gully, Hickory Slough.

CHARACTERISTICS: Historically rural; experiencing suburban/residential development which is projected to continue in the future.

STATEWIDE RANKINGS: 1976 11 1977 8

MAJOR PERMITTED DISCHARGES: MUNICIPAL 10 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	6.7	10.8	373	450
INDUSTRIAL	---	----	---	---

CURRENT MUNICIPAL PERMIT:
5 mg/l BOD, 12 mg/l TSS, 5 mg/l NH_3-N, 2 mg/l P as monthly averages (modified effluent set 3NP).

FINDINGS:

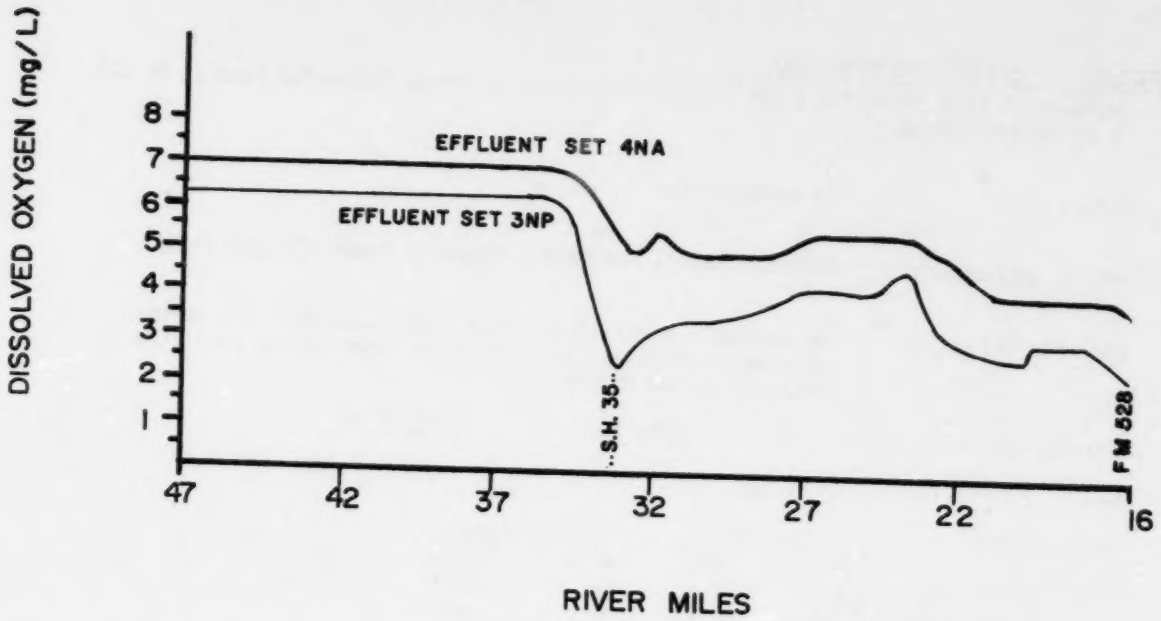
DRY WEATHER
- Dissolved oxygen levels projected to fall below goal of fishable/swimmable quality.
- Fecal coliform levels projected to meet goal of fishable/swimmable.
- Nonpoint source wasteloads not a significant problem.
- Nutrient loads do not affect water quality in this segment but comprise a portion of the total load entering Clear Lake.

WET WEATHER
- Based on unverified stormwater model, wet weather pollution is a problem in Clear Creek.
- Dissolved oxygen concentrations drop to low levels within the 1983-1990 time frame.
- Fecal coliform concentrations become excessive between present time and 1983; high concentrations linger 11-12 days after storm.
- 50-75% reduction in BOD needed by 1995 to protect fishable/swimmable uses.

MAJOR ALTERNATIVES CONSIDERED:

	COMMENT
DRY WEATHER	
- Operate existing and future municipal treatment facilities at current permit levels.	- Does not meet fishable/swimmable.
- Upgrade treatment efficiency to 5 mg/l BOD, 5 mg/l TSS, 3 mg/l NH_3-N, 1 mg/l P plus post-aeration (effluent set 4 NPA).	- Approaches fishable/swimmable.
- Upgrade treatment efficiency to 4 NPA with land disposal	- Meets fishable/swimmable; insufficient land available.
- Transport certain plant effluents at Level 2 (10 mg/l BOD, 15 mg/l TSS) to Houston Ship Channel; upgrade remaining plants to 4 NPA.	- Meets fishable/swimmable; potential economic incentives; political feasibility in question.
- Remove phosphorous controls in all alternatives considered.	- Cost/benefit of phosphorous control in question.
WET WEATHER	
- Immediate implementation of nonstructural controls.	- Unreliable data base to support firm recommendations.
- Develop test areas to monitor effectiveness of nonstructural controls.	- Allow for development of reliable data base.

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER
- Eliminate phosphorous removal requirements; reinstate if Clear Lake eutrophication study shows need.
- Evaluate interbasin transport of major municipal wasteloads (at effluent set 2) to Houston Ship Channel watershed in order to achieve economic advantages and fishable/swimmable quality.
- If interbasin transport not feasible, upgrade and operate existing facilities at effluent set 4 NA and drop dissolved oxygen standard to 4.5 mg/1.
- Institute a monitoring program to update and verify dry weather model.
- Maximum limits on chlorine residuals in plant effluents should be considered by Texas Department of Water Resources.
- Implement a strong enforcement policy to ensure permit compliance.

WET WEATHER
- Calibrate and verify wet weather model inputs and response.
- Select and develop test areas to monitor the effectiveness of nonstructural controls.
- If verified models confirm potential water quality problems:
  (1) Expand test area program.
  (2) Reserve sufficient land to implement nonstructural controls.
  (3) Based on test area results, implement most satisfactory nonstructural controls.
- Closely coordinate with flood control projects, particularly as related to water quality impacts and implementation of nonstructural controls.
- Encourage best management practices to reduce amount of pollutants to stream.
- Formulate wet weather standards consistent with goal of fishable/swimmable quality.

COSTS:

- Potential cost savings of $4.5 million with implementation of interbasin transport and upgrading remaining discharges to 4 NA when compared with upgrading all discharges to 4 NA with no interbasin transport.
- Potential cost savings with removal of phosphorous controls (see Clear Lake Costs, p. 33).
- Those associated with updating and verification of dry weather model and calibration and verification of wet weather model.
- Potential increased costs of chlorination control.

CLEAR CREEK TIDAL (SEGMENT 1101)

WATERSHED/SEGMENT DESCRIPTION:

Includes 12 miles from the upper end of Clear Lake to normal tidewater head at FM 528 in Galveston County.

AREA: 50 square miles.

MAJOR TRIBUTARIES: Robinson Bayou, Cow Bayou, Magnolia Creek, Chigger Creek.

CHARACTERISTICS: Historically rural/agricultural (pastureland), oil fields; suburban/residential and commercial development predicted to increase in the future.

STATEWIDE RANKINGS: 1976 56 1977 57

MAJOR PERMITTED DISCHARGES: MUNICIPAL 6 INDUSTRIAL 2

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	2.5	5.9	64	246
INDUSTRIAL	0.4	0.7	14	22

CURRENT MUNICIPAL PERMIT:
5 mg/l BOD, 12 mg/l TSS, 5 mg/l NH_3-N, 2 mg/l P as monthly averages (modified effluent set 3NP).

FINDINGS:

DRY WEATHER
- Will meet goal of fishable/swimmable quality at current permit levels with proper operation and maintenance.
- Nonpoint source loads, other than dredging operations, are not a significant problem.
- Dredging operations, every three years for 3-month duration, contribute an additional 1,800 lb/day BOD as well as high concentrations of suspended solids.
- Nutrient loads do not affect water quality in this segment but comprise a portion of the total load entering Clear Lake.

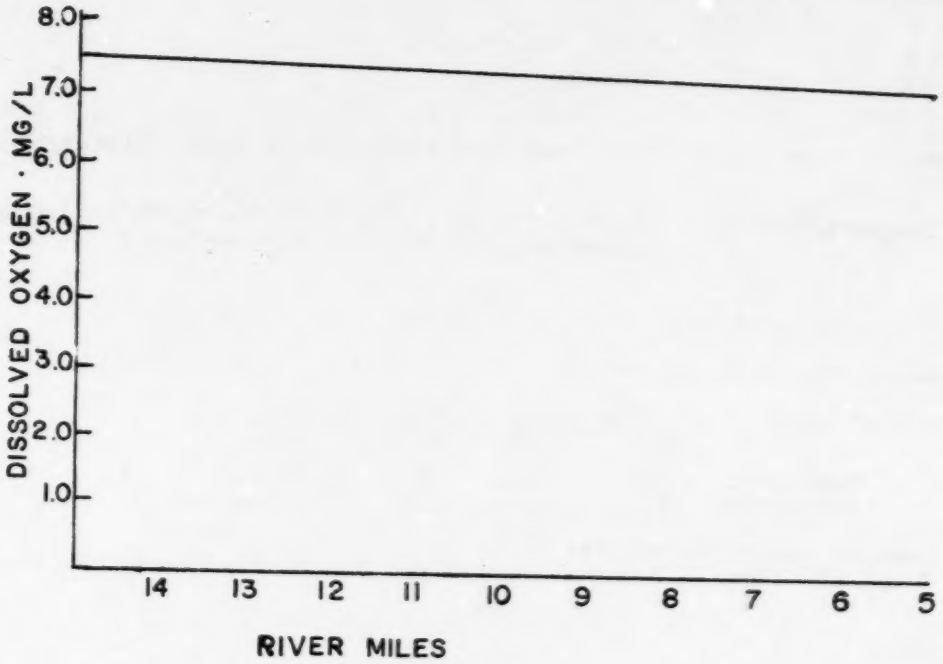
WET WEATHER
- Stormwater simulation model has not been developed for this segment.
- Water quality may reflect that evidenced in the Clear Creek nontidal segment due to similar land uses and growth patterns.

MAJOR ALTERNATIVES CONSIDERED:

	COMMENTS
DRY WEATHER	
- Operate existing and future municipal wastewater treatment facilities at current permit levels.	- Meets fishable/swimmable.
- Operate existing and future municipal wastewater treatment facilities at current permit levels, removing phosphorous controls.	- Cost/benefit of phosphorous control in question.
WET WEATHER	
- Please refer to write-up for Clear Creek (nontidal); p. 28.	

CLEAR CREEK TIDAL (SEGMENT 1101)

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER

- Eliminate phosphorous removal requirements; reinstate if Clear Lake eutrophication study shows need.
- Operate existing and future municipal wastewater treatment facilities at 5 mg/l BOD, 12 mg/l TSS, 5 mg/l NH_3-N as monthly averages.
- Dredging activities should be prohibited during critical dry weather conditions.
- Maximum limits on chlorine residual in plant effluents should be considered by Texas Department of Water Resources.

WET WEATHER

- Evaluate problems and potential solutions in conjunction with recommendations for nontidal portion (p. 29).
- Encourage use of best management practices to reduce the amount of pollutants to the stream.

COSTS:

- Those necessary to meet current permit levels without phosphorous controls.
- Potential savings for removal of phosphorous controls (see Clear Lake costs p. 33).
- Potential increased cost for chlorination control.
- Sampling and analytical work to determine if wet weather water quality parallels that predicted for nontidal segment.

CLEAR LAKE (SEGMENT 2425)

WATERSHED/SEGMENT DESCRIPTION:

Located 23 miles southeast of downtown Houston between Harris and Galveston Counties.

AREA: 86 square miles.

MAJOR TRIBUTARIES: Clear Creek, Armand Bayou, Taylor Bayou, Jarbo Bayou.

CHARACTERISTICS: Serves as a major contact recreation facility. Surrounded by high degree of urban/suburban development.

STATEWIDE RANKINGS: 1976 121 1977 90

MAJOR PERMITTED DISCHARGES: MUNICIPAL 4 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	.960	1.01	188	42
INDUSTRIAL	----	----	---	--

CURRENT MUNICIPAL PERMIT:
5 mg/l BOD, 12 mg/l TSS, 5 mg/l NH_3-N, 2 mg/l P as monthly averages (modified effluent set 3 NP).

FINDINGS:

DRY WEATHER
- Will meet goal of fishable/swimmable quality at current permit levels with proper operation and maintenance.
- Dredging operations add 1,800 lbs per day BOD plus high TSS concentrations; dredging activity is infrequent.
- Other than dredging operations, nonpoint source wasteloads pose no significant oxygen demand problem.

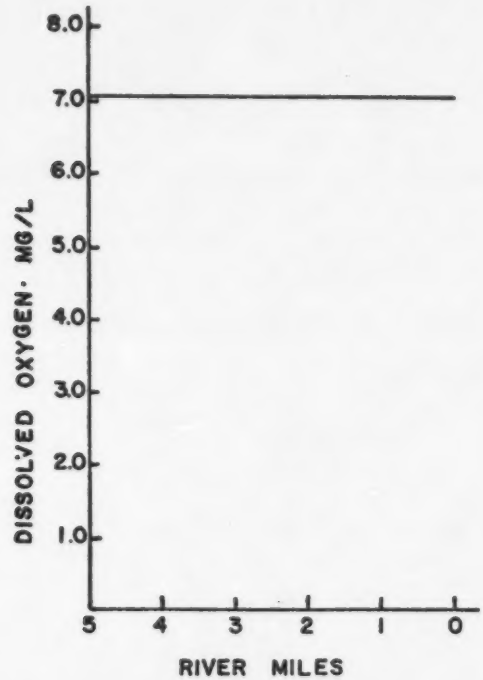
WET WEATHER
- Wet weather simulation model has not been developed for this segment.
- Water quality may reflect that evidenced in Clear Creek nontidal segment due to similar land uses and growth patterns.
- Nutrient loads are estimated to be about 20 times the load at which eutrophication problems could arise.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION:	COMMENT:
- Operate existing and future municipal wastewater treatment facilities at current permit levels.	- Meets fishable/swimmable.
- Drop phosphorous controls over entire watershed for existing and future facilities.	- Cost/benefit of phosphorous removal in question.
- Increase phosphorous controls over entire watershed for existing and future facilities.	- Phosphorous load decrease insignificant.

CLEAR LAKE (SEGMENT 2425)

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER

- Operate existing and future municipal wastewater treatment facilities at 5 mg/l BOD, 12 mg/l TSS, 5 mg/l NH_3-N, as monthly averages (modified effluent set 3N).
- Eliminate phosphorous controls; reinstate if eutrophication study shows need.
- Prohibit dredging operations during critical dry weather conditions.
- Maximum limits on chlorine residuals in plant effluents should be considered by Texas Department of Water Resources.

WET WEATHER

- Initiate wet weather water quality monitoring program to determine if any similarities exist with predicted quality in the Clear Creek Nontidal segment.
- Formulate wet weather standards consistent with fishable/swimmable goal.

COSTS:

- Those needed to meet current permit levels without phosphorous controls.
- Potential cost savings to the entire Clear Lake Watershed of $6 million, with removal of phosphorous controls.
- Those associated with eutrophication studies.
- Those associated with wet weather water quality monitoring program.

ARMAND BAYOU

WATERSHED/SEGMENT DESCRIPTION:

Major tributary of Clear Lake, tidally influenced and located 10 miles southeast of downtown Houston.

CHARACTERISTICS: Suburban/residential development; highly utilized nature study area.

STATEWIDE RANKINGS: 1976 -- 1977 --

MAJOR PERMITTED DISCHARGES: MUNICIPAL 3 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	2.64	6.65	74	281
INDUSTRIAL	----	----	--	---

CURRENT MUNICIPAL PERMIT:
5 mg/1 BOD, 12 mg/1 TSS, 5 mg/1 NH_3-N, 2 mg/1 P as monthly averages (modified effluent set 3 NP).

FINDINGS:

DRY WEATHER
- Findings dependent on accuracy of simplified, nonspecific stream model.
- Dissolved oxygen levels projected to fall below goal of fishable/swimmable.
- Fecal coliform level will meet goal of fishable/swimmable.
- Nutrient loadings present no water quality problem in this segment, but comprise a portion of the loading to Clear Lake.

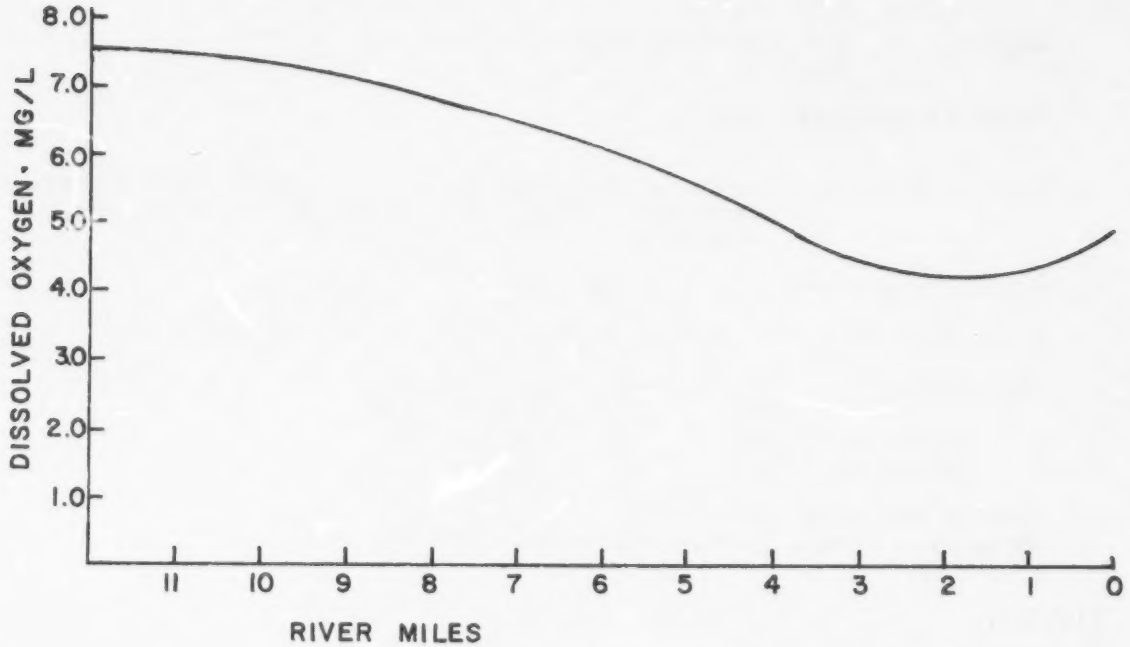
WET WEATHER
- There is no existing wet weather model for this segment.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION:	COMMENT:
- Operate existing and future municipal wastewater treatment facilities at current permit levels.	- Does not meet fishable/swimmable according to simplified model.
- Utilize interbasin transport of major discharge.	- Meets fishable/swimmable; political feasibility in question.
- Remove phosphorous controls.	- Cost/benefit of phosphorous controls in question.

ARMAND BAYOU

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER

- Operate existing and future municipal wastewater treatment facilities at 5 mg/1 BOD, 12 mg/1 TSS, 5 mg/1 NH_3-N as monthly averages (modified effluent set 3 N).
- Drop phosphorous controls; reinstate if Clear Lake eutrophication study shows need.
- Institute a water quality monitoring program to develop a calibrated/verified model.
- Maximum limits on chlorine residuals in plant effluents should be considered by Texas Department of Water Resources.

WET WEATHER

- Institute a wet weather water quality monitoring program to determine if water quality problems exist similar to Clear Creek nontidal.

COSTS:

- Those needed to meet current permit levels without phosphorous controls.
- Potential cost savings for removal of phosphorous controls (see Clear Lake Costs p. 33).
- Those associated with monitoring programs to develop dry weather model and determine wet weather water quality.
- Potential increased costs for chlorination controls.

DICKINSON BAYOU NONTIDAL (SEGMENT 1104)

WATERSHED/SEGMENT DESCRIPTION:

Headwaters in eastern Brazoria County, extends 9.5 miles downstream to tidal headwater at river mile 13.5.

AREA: 50 square miles.

MAJOR TRIBUTARIES: None.

CHARACTERISTICS: Historically rural and agricultural (cattle, rice); scattered producing oil and gas wells; development primarily suburban/residential.

STATEWIDE RANKINGS: 1976 17 1977 17

MAJOR PERMITTED DISCHARGES: MUNICIPAL 1 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	.137	.18	18	15
INDUSTRIAL	----	---	--	--

CURRENT MUNICIPAL PERMIT:
20 mg/1 BOD, 20 mg/1 TSS as monthly averages (effluent set 1).

FINDINGS:

DRY WEATHER
- Based on nonspecific water quality model, DO concentrations approach fishable/swimmable.
- Fecal coliform concentrations will meet fishable/swimmable.
- Nonpoint source wasteloads present no water quality problem in this segment.
- Nutrient wasteloads present no water quality problem in this segment.

WET WEATHER
- There is no existing stormwater model.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION	COMMENT
- Operate existing future municipal wastewater treatment facilities at current permit levels.	- Approaches fishable/swimmable.
- Upgrade existing level of treatment to 10 mg/1 BOD, 15 mg/1 TSS as monthly averages (effluent set 2).	- Meets fishable/swimmable.

DICKINSON BAYOU NONTIDAL (SEGMENT 1104)

DISSOLVED OXYGEN PROFILE

NONE AVAILABLE

RECOMMENDATIONS:

DRY WEATHER

- Operate existing municipal wastewater treatment facilities at current permit level (effluent set 1).
- Upgrade level of municipal wastewater treatment to effluent set 2 prior to 1995 as required by increased wasteloads.
- Extend verified model recommended for tidal segment to include nontidal segment.
- Maximum limits on chlorine residual in plant effluents should be considered by Texas Department of Water Resources.
- Consider adopting standard of 8 mg/l of NH_3-N for use in permits where more restrictive levels do not apply.

WET WEATHER

- Institute a wet weather water quality monitoring program.

COSTS:

- Those necessary to operate and maintain municipal wastewater treatment facilities at effluent set 1.
- Those necessary to upgrade municipal wastewater treatment facilities to effluent set 2 by 1995.
- Those associated with wet weather water quality monitoring program.
- Those associated with extending a verified (dry weather) water quality model to include the nontidal segment.

DICKINSON BAYOU TIDAL (SEGMENT 1103)

WATERSHED/SEGMENT DESCRIPTION:

Upper reach of this segment is river mile 13.5 near Cemetery Road; enters Galveston Bay through Dickinson Bayou; comprises urbanized portion of the Dickinson Bayou watershed.

AREA: 60 square miles.

MAJOR TRIBUTARIES: Green Bayou, Benson Bayou, Magnolia Bayou (Geissler Gully), Borden's Gully.

CHARACTERISTICS: Historically rural and agricultural (cattle, rice); urban development centered around City of Dickinson with associated suburban/residential development.

STATEWIDE RANKINGS: 1976 23 1977 29

MAJOR PERMITTED DISCHARGES: MUNICIPAL 3 INDUSTRIAL 1

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	2.7	4.98	63	415
INDUSTRIAL	0.1	0.20	7	9

CURRENT MUNICIPAL PERMIT:
10 mg/l BOD, 15 mg/l TSS, 2 mg/l P as monthly averages (effluent set 2P).

FINDINGS:

DRY WEATHER
- Based on a nonspecific water quality model, dissolved oxygen concentrations will not meet fishable/swimmable.
- Fecal coliform concentrations will meet fishable/swimmable.
- Nutrient loads present no water quality problem in this segment.
- DO concentrations in stream sensitive to NH_3-N discharges of concentrations greater than 8 mg/l.

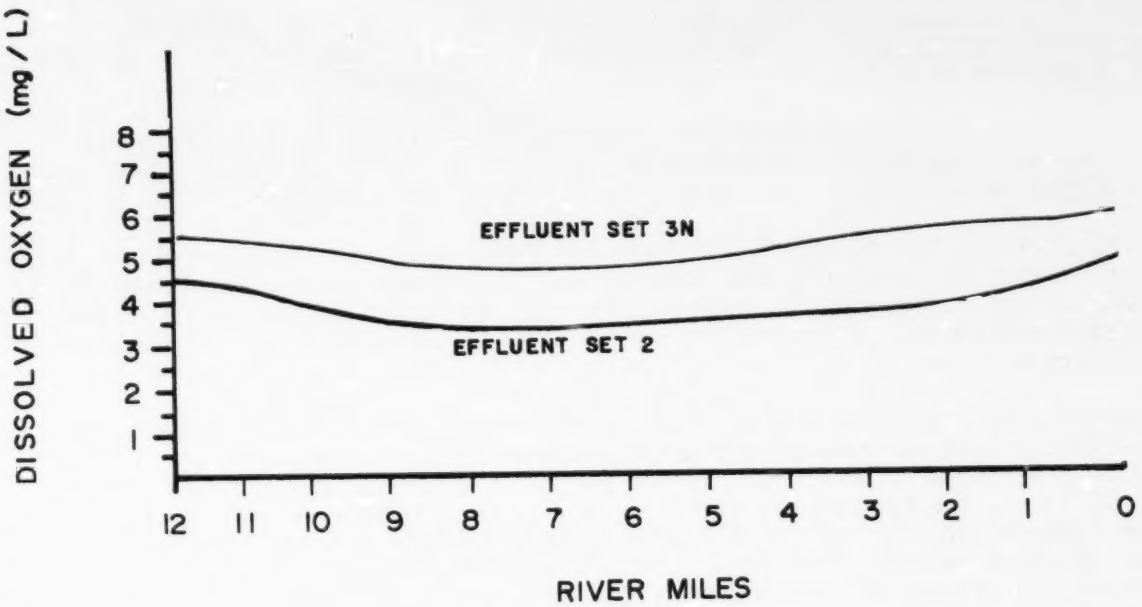
WET WEATHER
- There is no stormwater model for this segment.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION	COMMENT
- Operate existing and future municipal wastewater treatment fracilities at current permit levels.	- Does not meet fishable/swimmable in 1995.
- Upgrade existing level of municipal wastewater treatment to 5 mg/l BOD, 10 mg/l TSS, 5 mg/l NH_3-N, 2 mg/l P as monthly averages (effluent set 3 NP).	- Meets fishable/swimmable.
- Remove phosphorous controls.	- Cost benefit of phosphorous controls in question.

DICKINSON BAYOU TIDAL (SEGMENT 1103)

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER
- Eliminate phosphorous control requirements.
- Operate existing municipal wastewater treatment facilities at 10 mg/1 BOD, 15 mg/1 TSS (effluent set 2).
- Construct future facilities with the provision for upgrading to 5 mg/1 BOD, 10 mg/1 TSS, 5 mg/1 NH_3-N (effluent set 3N).
- Develop a dry weather model to justify upgrading municipal wastewater treatment facilities to effluent set 3N or some other standard.
- Maximum limits on chlorine residual in plant effluents should be considered by Texas Department of Water Resources.
- Consider adopting effluent standard of 8 mg/1 of NH_3-N for use in permits where more restrictive levels do not apply.

WET WEATHER
- Institute a wet weather water quality monitoring program.

COSTS:
- Those necessary to operate and maintain municipal wastewater treatment facilities at effluent set 2.
- Potential increased costs for upgrading facilities to effluent set 3N.
- Potential cost savings in eliminating phosphorous controls.
- Those associated with wet weather water quality monitoring program.
- Those associated with the development of a verified dry weather water quality model.

HOUSTON SHIP CHANNEL SUBBASIN

This subbasin is located in the central portion of the 208 planning area. The major waterways are the Houston Ship Channel (HSC) and Lower San Jacinto River. Aside from being the major transport vehicle for large quantities of wastes from the Houston urban-industrial complex, the Houston Ship Channel is a major navigation artery linking the Port of Houston with Galveston Bay and the Gulf of Mexico. Approximately 11 percent of the point source discharges located along the HSC account for 95 percent of the oxygen demanding materials discharged directly into this waterway.

The HSC receives significant contributions of municipal and industrial wasteloads via numerous tributaries including Buffalo Bayou, White Oak Bayou, Brays Bayou, Sims Bayou, Hunting Bayou, Vince Bayou, Greens/Halls Bayou, and Carpenter Bayou.

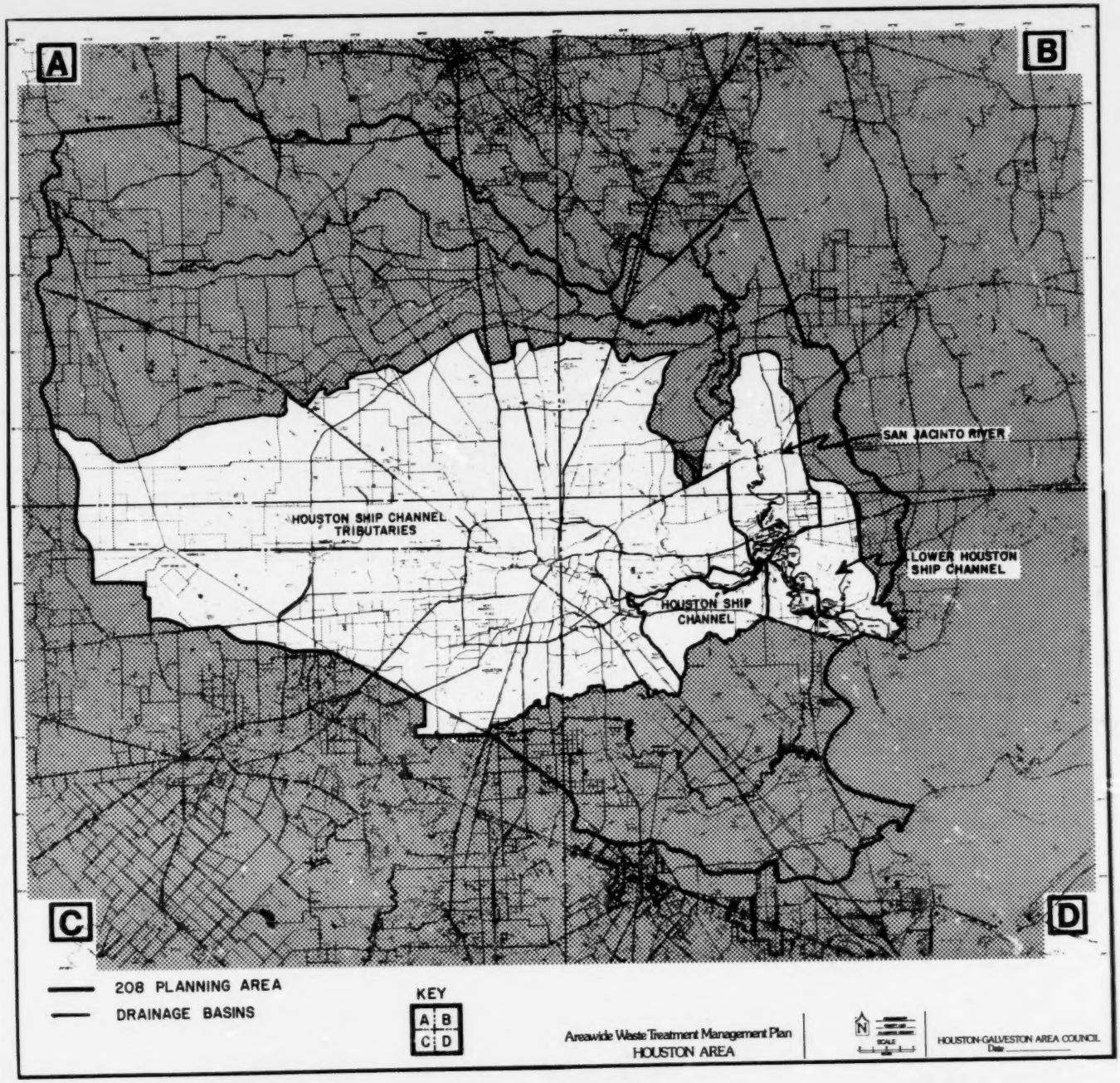
At the lower end of the HSC are located several large side bays which provide a source of recreational activity and serve as nursery grounds for several commercially important marine species (e.g., shrimp). The area surrounding these bays includes undeveloped land (where local wildlife can be observed) as well as residential and industrial development.

The Lower San Jacinto River extends from its confluence with the HSC upstream some 20 miles to the Lake Houston Dam and has long been utilized as a source of contact recreation. During most of the year 60 percent of the total fresh water discharge to the HSC is via the San Jacinto River. However, for extended periods of low flow the fresh water flow rate may range from 0 to 10 cfs (cubic feet per second). This waterway receives drainage from large tracts of undeveloped land, as well as from residential and industrial development. Most municipal point source discharges enter via Jackson Bayou which, with Grants Spring Creek, constitute the major tributaries of the Lower San Jacinto River. This waterway is greatly influenced by the Houston Ship Channel through tidal action.

The soils of this subbasin are generally clayey, loamy soils which are slowly permeable and poorly drained. Soils of this type tend to increase the effects of flooding, particularly when one storm event is closely followed by another. Situations of this nature have led to proposals for major flood control efforts by the U.S. Army Corps of Engineers.

Vegetation is Bluestem Prairie, a dense to open grassland comprised predominantly of Big and Little Blue Stem, Switch Grass, and Indian Grass.

Principal birdlife of this subbasin include Bobwhite Quail, Mourning Dove, Common Snipe, Sandhill Crane, Canada, Lesser Canada, Snow, and Blue Geese as well as Mallard, Mottled, Godwall, American Widgeon, Teal, Shoveler, Canvasback Redhead, and Ring-necked Ducks. Principal mammals include white-tailed Deer, Eastern Grey, and Fox Squirrels, Opossum, Racoon, Skunk, and Swamp Rabbit. There are several species of turtles, toads, lizards, salamanders, and snakes to be found within this subbasin.


A
B
C
D
SAN JACINTO RIVER
HOUSTON SHIP CHANNEL TRIBUTARIES
LOWER HOUSTON SHIP CHANNEL
HOUSTON SHIP CHANNEL
208 PLANNING AREA
DRAINAGE BASINS
KEY
A B
C D
Areawide Waste Treatment Management Plan
HOUSTON AREA
N
SCALE
HOUSTON-GALVESTON AREA COUNCIL
Date

HOUSTON SHIP CHANNEL

WATERSHED/SEGMENT DESCRIPTION:

Houston Ship Channel Proper
Segment 1005-Morgans Point to San Jacinto River
Segment 1006-San Jacinto River to Turning Basin
Segment 1007-Turning Basin

Side Bays
Segment 2426-Tabbs
Segment 2427-San Jacinto
Segment 2428-Black Duck
Segment 2429-Scott
Segment 2430-Burnett

AREA: 1,110 square miles.

MAJOR TRIBUTARIES: Lower San Jacinto River, Carpenters Bayou, Greens/Halls Bayou, Hunting Bayou, Vince Bayou, Sims Bayou, Brays Bayou, Buffalo Bayou, White Oak Bayou.

CHARACTERISTICS: Highly urbanized and industrial area; high degree of shipping activity; side bays offer recreational activities.

STATEWIDE RANKINGS:

	1005	1006	1007		1005	1006	1007
1976	59	3	1	1977	61	2	1

MAJOR PERMITTED DISCHARGES: MUNICIPAL 9* INDUSTRIAL 65*
*Does not include discharges to tributaries

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	215.8	323	76,698	27,237
INDUSTRIAL	272.7	717.2	25,319	20,779

CURRENT MUNICIPAL PERMIT:
City of Houston 69 Street/North Side & Sims Bayou
10 mg/l BOD, 15 mg/l TSS, 5 mg/l NH_3-N (effluent set 2N).
All Others
10 mg/l BOD, 15 mg/l TSS as monthly averages (effluent set 2).

FINDINGS:

DRY WEATHER
- Water quality of Segment 1007 (Turning Basin) dominated by municipal wasteloads entering through tributaries.
- Dissolved oxygen concentrations do not meet fishable/swimmable in Segment 1007, but achieve fishable/swimmable in Segment 1005 and the lower portion of Segment 1006.
- Fecal coliform concentrations meet fishable/swimmable in all segments.
- Water quality in all side bays meet fishable/swimmable.
- Wasteloads entering Segment 1005 have minimal effect on dissolved oxygen profiles of Segments 1006 and 1007.
- Nonpoint source wasteloads other than dredging and benthal load present no water quality problem.
- Benthal loads may be significant and are not well defined.
- Instream aeration offers potential for increasing assimilative capacity of Lower Ship Channel (Segment 1005) while meeting goal of fishable/swimmable.

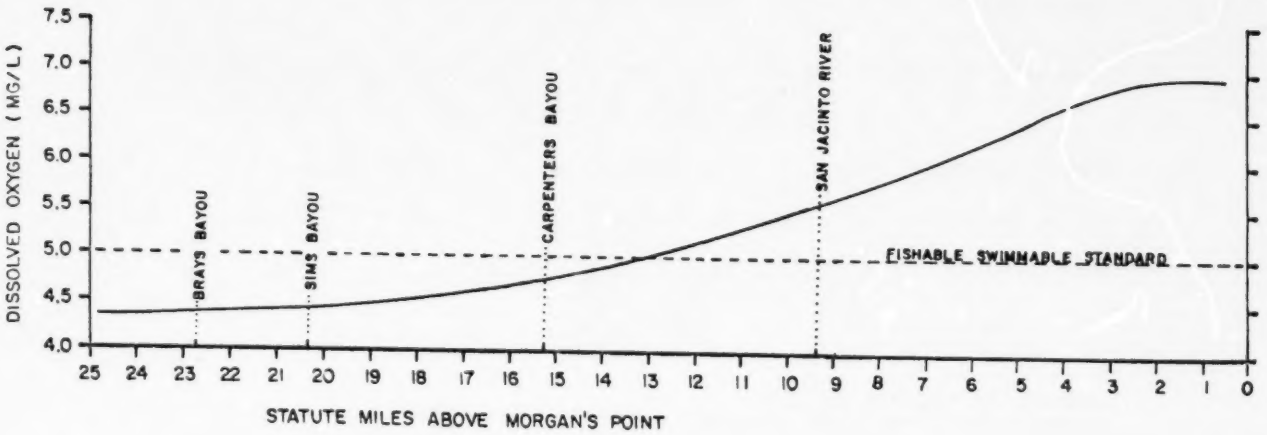
WET WEATHER
- Unverified stormwater model indicates significant water quality problems during wet weather such that fishable/swimmable in unattainable. This finding does not correlate with recent observations.
- DO level drops below 1.0 mg/l throughout most of Houston Ship Channel; recovery period is long (at least 10 days); up to 75% BOD reduction to meet goal of fishable/swimmable.

MAJOR ALTERNATIVES CONSIDERED:

	COMMENT
DRY WEATHER	
- Operate existing municipal wastewater treatment facilities at current permit levels and existing and future industrial wastewater treatment facilities at Federally-mandated standards.	- Does not meet fishable/swimmable for Segment 1007 and upper portion of Segment 1006. Does meet fishable/swimmable for Segment 1005, lower portion of Segment 1006, as well as all side bays.
- Upgrade major municipal facilities contributing to critical dissolved oxygen concentration to effluent set 4N. Operate all others as above.	- Same as above.
- Operate existing and future municipal and industrial facilities as in first alternative plus instream aeration.	- Meets fishable/swimmable.
- Increase wasteload allocations for Segment 1005.	- Minimal additional instream aeration needed to meet fishable/swimmable.
WET WEATHER	
- Hold first flush.	- Does not meet fishable/swimmable.
- Reduce nonpoint source wasteloads 50%.	- Does not meet fishable/swimmable.
- Reduce nonpoint source wasteloads 75%.	- Meets fishable/swimmable. Cost prohibitive.

HOUSTON SHIP CHANNEL

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER
- No new point source controls until it is determined if fishable/swimmable is attainable.
- Verify dry weather model with emphasis on nitrogenous and benthal oxygen demands.
- Expand dry weather model to include all tributaries receiving major wasteloads.
- Actively evaluate instream aeration to obtain additional stream assimilative capacity if fishable/swimmable standards are to be met.

WET WEATHER
- Institute a wet weather water quality monitoring program.
- If monitoring indicates fishable/swimmable condition is attainable, develop a verified model for both inputs and response.
- If monitoring indicates fishable/swimmable is unattainable, existing standards should not be changed.

COSTS:

- Those needed to operate and maintain existing and future municipal wastewater treatment facilities at current permit levels.
- Those needed to operate and maintain existing and future industrial wastewater treatment facilities at Federally-mandated standards.
- Those associated with dry weather model verification and expansion.
- Those needed to implement a wet weather water quality monitoring program.
- Potential cost of developing a verified stormwater model based on results of the wet weather monitoring program.
- Potential cost for implementation of instream aeration.

SAN JACINTO RIVER TIDAL (SEGMENT 1001)

WATERSHED/SEGMENT DESCRIPTION:

Extends from 200 yards below IH-10 upstream 20 miles to Lake Houston Dam.

AREA: 60 square miles.

MAJOR TRIBUTARIES: Jackson Bayou, Granite Spring Creek.

CHARACTERISTICS: Used extensively for contact recreation, some industrial development in lower portion with several residential developments along the Segment.

STATEWIDE RANKINGS: 1976 57 1977 56

MAJOR PERMITTED DISCHARGES: MUNICIPAL 9 INDUSTRIAL --

WASTELOADS:

	FLOW (MGD)		BOD (LBS/DAY)	
	1975	1995	1975	1995
MUNICIPAL	1.0	2.39	312	199
INDUSTRIAL	1.8	8.3	234	420

CURRENT MUNICIPAL PERMIT:
10 mg/l BOD, 15 mg/l TSS as monthly averages (effluent set 2).

FINDINGS:

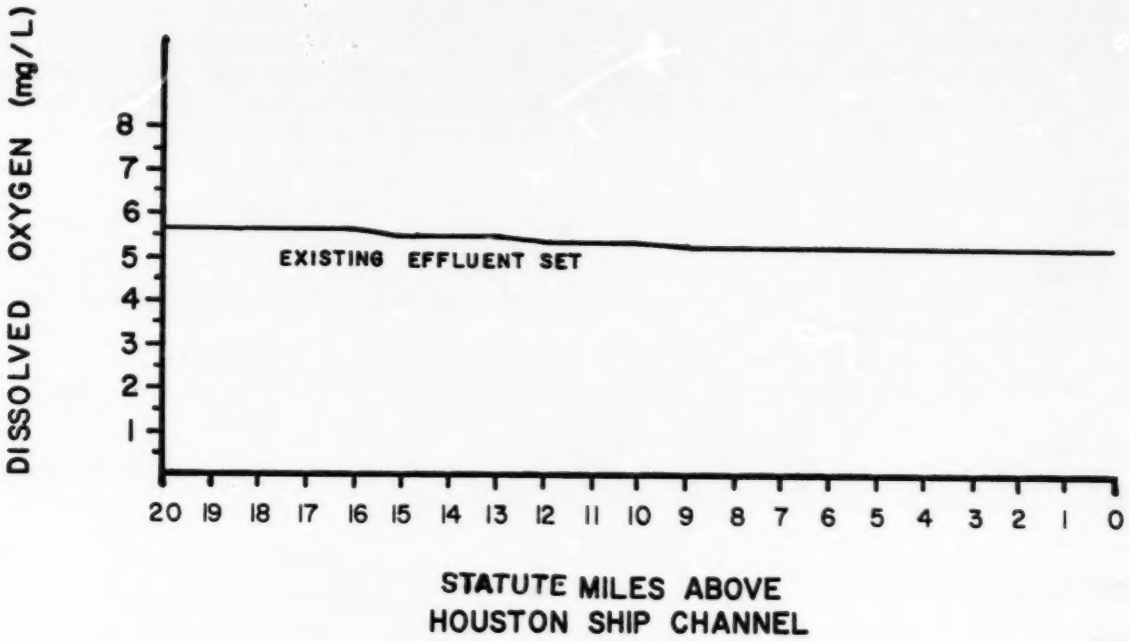
DRY WEATHER
- Will meet goal of fishable/swimmable quality at existing permit levels with proper operation and maintenance.
- Water quality in lower portion dominated by Houston Ship Channel.
- Wasteloads during dredging operations estimated to be 8,600 lbs. BOD/day, which is far in excess of BOD loads from point sources.
- Dry weather model does not consider benthal load.

WET WEATHER
- Uncalibrated, unverified stormwater model results indicate non-compliance with dry weather standards only in the lower portion where water quality is influenced by the Houston Ship Channel.

MAJOR ALTERNATIVES CONSIDERED:

DESCRIPTION	COMMENT
- Operate existing and future municipal wastewater treatment facilities at current permit levels with no regionalization.	- Meets fishable/swimmable.
- Operate existing and future municipal facilities at current permit levels with regionalization.	- Meets fishable/swimmable; economic incentives in question.

DISSOLVED OXYGEN PROFILE



RECOMMENDATIONS:

DRY WEATHER
- Operate existing and future municipal wastewater treatment facilities at 10 mg/l BOD, 15 mg/l TSS (effluent set 2).
- Consider adopting effluent standard of 8.0 mg/l of NH_3-N for use in permits where more restrictive levels do not apply.
- Prohibit dredging during critical dry weather conditions.
- Update dry weather model with emphasis on benthal load.
- Monitor water quality to measure impact of Houston Ship Channel.

WET WEATHER
- Institute wet weather water quality monitoring program, including measuring the impact of the Houston Ship Channel on the lower portion of this Segment.
- Formulate wet weather standards consistent with fishable/swimmable.

COSTS:

- Those needed to operate and maintain municipal wastewater treatment facilities at effluent set 2.
- Those associated with updating the dry weather model.
- Potential increased costs for NH_3-N controls.
- Those associated with dry and wet weather water quality monitoring programs.

BUFFALO BAYOU

WATERSHED DESCRIPTION

Unclassified stream with headwaters near the City of Katy. Major channel originates below Addicks and Barker Dams and flows easterly some fifty river miles to its entry into the Houston Ship Channel. Much of the area adjacent to the stream has remained in a natural state and is considered a scenic and recreational attraction of the City. The bayou is a focal point of the City's park system with a landscaped parkway along its banks through the center of town. Residential areas are also centered around the bayou's natural setting. Buffalo Bayou is a major transport vehicle of urban runoff. Rapid growth is taking place in the western portions of this watershed.

FINDINGS

DRY WEATHER
- Based on a "nonspecific" model, dissolved oxygen concentration will not meet the goal of fishable/swimmable.
- Fecal coliform concentrations will meet the goal of fishable/swimmable.
- Much public interest has been generated in the over-all condition of this bayou.

WET WEATHER
- As indicated by Houston Ship Channel stormwater model, there are no apparent water quality problems in the lower five miles of this bayou.

RECOMMENDATIONS

DRY WEATHER
- Classify that section of the bayou between the Turning Basin and Addicks/Barker Dams.
- Determine desired water quality for classified segment consistent with non-contact recreation and preservation of bayou aesthetics.
- Extend Houston Ship Channel model to include Buffalo Bayou up to Barker Dam and determine wasteload allocations consistent with water quality standards.

WET WEATHER
- Formulate wet weather standards consistent with non-contact recreational activities.
- Monitor wet weather water quality.
- Utilize modeling efforts currently underway under the direction of the City of Houston Health Department and Rice University.
- Closely coordinate all efforts with flood control projects, particularly as related to water quality impacts and implementation of nonstructural controls.

OTHER TRIBUTARIES OF THE HOUSTON SHIP CHANNEL

WATERSHED DESCRIPTION

Included are Brays Bayou, Sims Bayou, White Oak Bayou, Hunting Bayou, Vince Bayou, Greens/Halls Bayou, and Carpenter Bayou. All but the upper reaches of the Greens/Halls and Carpenter Bayous flow through the heavily urbanized Houston metropolitan area. Dry weather flows in these tributaries consist largely of sewage treatment plant effluent. Several of the bayous have been lined with concrete to mitigate flooding conditions. Recreational uses consist of hike and bike trails along these watercourses.

FINDINGS

- Fishable/swimmable unattainable for White Oak, Sims, Greens/Halls, and Carpenter Bayous under existing levels of treatment.
- Significant expenditures required to meet fishable/swimmable in Brays, Vince, and Hunting Bayous.

RECOMMENDATIONS

- Do not classify.
- Attempt to meet fecal coliform concentrations of less than 200 MPN/100 ml.
- Operate existing and future municipal wastewater treatment facilities at current permit levels.
- Operate existing and future industrial wastewater treatment facilities at Federally-mandated standards.

WHO WILL CARRY OUT THE PLAN?

One of the unique aspects of Section 208 provisions is the requirement that the plan specifically identify those agencies to be responsible for plan implementation. This requirement is perhaps the MOST IMPORTANT ASPECT of the 208 effort. It is this management feature that distinguishes the 208 Program from past water quality planning efforts

The Act and ensuing regulations clearly emphasize the requirements for assigning management responsibilities. The law states that,

> "Any plan prepared under such process shall include, but not be limited to . . . the identification of those agencies necessary to construct, operate and maintain all facilities required by the plan and otherwise to carry out the plan . . ."

AND MORE SPECIFICALLY . . .

October 18, 1972 Pub. Law 92-500 86 STAT. 842

through (K) of paragraph (2) of this subsection shall be developed and submitted by the Governor to the Administrator for application to all regions within such State.

"(c)(1) The Governor of each State, in consultation with the planning agency designated under subsection (a) of this section, at the time a plan is submitted to the Administrator, shall designate one or more waste treatment management agencies (which may be an existing or newly created local, regional, or State agency or political subdivision) for each area designated under subsection (a) of this section and submit such designations to the Administrator. Regional operating agencies, designation.

"(2) The Administrator shall accept any such designation, unless, within 120 days of such designation, he finds that the designated management agency (or agencies) does not have adequate authority—

"(A) to carry out appropriate portions of an areawide waste treatment management plan developed under subsection (b) of this section;

"(B) to manage effectively waste treatment works and related facilities serving such area in conformance with any plan required by subsection (b) of this section;

"(C) directly or by contract, to design and construct new works, and to operate and maintain new and existing works as required by any plan developed pursuant to subsection (b) of this section;

"(D) to accept and utilize grants, or other funds from any source, for waste treatment management purposes;

"(E) to raise revenues, including the assessment of waste treatment charges;

"(F) to incur short- and long-term indebtedness;

"(G) to assure in implementation of an areawide waste treatment management plan that each participating community pays its proportionate share of treatment costs;

"(H) to refuse to receive any wastes from any municipality or subdivision thereof, which does not comply with any provisions of an approved plan under this section applicable to such area; and

"(I) to accept for treatment industrial wastes.

From the above direct requirements, other sections of the Act, and Federal/State Guidelines, ten major functions regarding waste treatment management have been defined:

- Standard setting
- Permitting and regulation (Point Source)
- Monitoring
- Enforcement
- Planning
- Operations and maintenance
- Design and construction
- Finance
- Management/Coordination
- Permitting and regulation (Nonpoint Source

WHAT ARE THE MANAGEMENT FUNCTIONS?

The functions to be performed by the management system were organized into five major groups:

- REGULATORY AND COMPLIANCE FUNCTIONS

  Standard Setting - establishment of measures of stream quality and effluent quality consistent with desired uses and EPA regulations.

  Permitting - the issuance of discharge permits (presently point source only) to conform to water quality standards.

  Monitoring - analysis of the quality of discharged effluent and stream water for compliance with standards and permits.

  Enforcement - administrative and/or legal action to assure compliance with regulations.

- WATER QUALITY PLANNING FUNCTION

  Short- and long-range comprehensive water quality planning, including relationship to other physical planning programs (for example, parks and recreation, transportation, housing, etc.).

- WASTEWATER TREATMENT FUNCTIONS

  The functions in this group are directly related to construction and operation of waste treatment facilities including development of detailed facilities plans and raising revenues for capital costs and operations. The activities performed in this functional group are intensive and highly localized.

  Design and Construction
  Operation and Maintenance
  Finance

- NONPOINT SOURCE CONTROL

  The establishment and implementation of programs to control pollution from nonpoint sources.

- MANAGEMENT/COORDINATION

  This function focuses on implementation of water quality programs at the local level. It formalizes working relationships between operators, regulatory agencies, and interest groups and affixes primary responsibility for progress toward 208 goals. Activities will include regional water quality policy setting, recommendation of action priorities, sharing of technical expertise, supervision of nonpoint program, and local input to Federal and State programs.

WHAT IS THE PRESENT SITUATION?

At the present time, wastewater treatment in the Houston area is provided by a variety of entities, including municipalities, water districts, and special purpose authorities. There are approximately 400 such units with operating authority. Service jurisdictions of these entities/agencies range from several hundred acres for the smaller districts to over 500 square miles for the City of Houston.

Water quality planning, though generally performed by local or regional entities, is funded and supervised at both the State and Federal levels. Nonpoint source pollution is a relatively new area of study. Although it is generally felt that nonpoint source control should be a local responsibility, few control programs have been developed in the Greater Houston Area.

There is no specific mechanism at the local level to coordinate the needs and activities of these participants. As such, some functions are duplicated, while others are not uniformly performed throughout the area (e.g., nonpoint source contorl, monitoring, and enforcement). This results in lost opportunities for efficiencies of scale, sharing of technical expertise, and accomplishment of common goals.

THE PRESENT SYSTEM DOES NOT MEET THE INTENT OF PUBLIC LAW 92-500.

Projected higher costs of treatment, continuing rapid growth, new regulations (particularly in regard to nonpoint requirements) competing demands for capital, and changes in technology will further aggravate the situation.

Moreover, the technical recommendations previously addressed in this Summary Report, clearly relate to the need for proper management, particularly in the areas of permit enforcement, plant operations, monitoring, and implementation of "best management practices".

IMPROVEMENTS IN MANAGEMENT SYSTEM WILL BE CRITICAL TO MEETING WATER QUALITY GOALS.

The 208 management analysis activity was designed to produce a system which would meet Federal, State, and local requirements and be responsive to the technical plans being developed. Criteria were established, with the assistance of the Advisory Committees to gauge the potential of various candidate agencies to assume major 208 management responsibilities.

CRITERIA
- Legal Authority
- Financial Capability
- Technical Competence
- Political Acceptability
- Public Accountability

The preferred approach in meeting management requirements would build on coordination of existing authorities, economics, incentives for voluntary conformance with the 208 plan, and efficient utilization of existing technical expertise.

The management analysis activity followed the basic steps in a planning process:

1. Inventory of existing agencies with wastewater treatment responsibilities
2. Assessment of capabilities and limitations regarding performance of 208 functions
3. Development of alternatives, starting with broad options and proceeding to specific alternatives
4. Selection of recommended alternative.

WHAT ARE THE MANAGEMENT ALTERNATIVES?

For each of the five functional groupings presented, an examination was made to select alternative entities that could meet the criteria for designation as the "management agency(ies)". The features of various alternatives were discussed and submitted to public review with the following alternatives remaining for further consideration. A recommendation for management responsibilities is presented for each functional group.

REGULATORY AND COMPLIANCE MANAGEMENT ALTERNATIVES

TEXAS DEPARTMENT OF WATER RESOURCES (TDWR)

- Newly consolidated state agency with full authority to carry out regulatory and compliance activities.
- Only agency that meets all criteria.
- Presently performs functions with participation of the EPA (permits and standards) and local governments (monitoring and enforcement).
- Existing staff, procedures and financial capacility.

RECOMMENDATION: TEXAS DEPARTMENT OF WATER RESOURCES

WATER QUALITY PLANNING ALTERNATIVES

(1) TEXAS DEPARTMENT OF WATER RESOURCES (TDWR)

- Presently does this planning for nondesignated 208 areas.
- Has funding and staff.
- Shifts areawide planning to State level.
- Cannot readily provide coordination with related local planning programs, i.e., air quality, transportation, and housing.
- Could be designated "planner" and contract with local agencies to perform tasks.
- Can provide long range view of State's needs and impacts on region.

(2) HOUSTON-GALVESTON AREA COUNCIL (H-GAC)

- Designated agency for initial 208 planning effort.
- Established procedures for public participation.
- Local elected official involvement.
- Established Environmental Division with staff and experience.
- Can relate water quality planning to other functional planning areas and to regional comprehensive plan.
- Need to acquire financing for ongoing water quality planning effort.
- Responsibility for reviewing applications for federal funding assistance (A-95).

(3) WATER QUALITY COUNCIL (Concept)

- Not currently existing, no track record.
- Could hire staff or contract with local agencies
- Concept as currently constructed for water quality only, would not have comprehensive planning view
- Planning gap until Council is operative.

RECOMMENDATION: HOUSTON-GALVESTON AREA COUNCIL

WASTEWATER TREATMENT MANAGEMENT ALTERNATIVES

(1) PRESENT SYSTEM CONTINUED

- Characterized by many public and private participants (about 400).
- Continued formation of new districts to treat wastewater in growth areas.
- Would require extensive coordination to assure actions consistent with 208 plan and objectives.
- Loss of potential economies of scale.
- Involves least change and disruption.

(2) PRESENT SYSTEM COORDINATED

- Adds coordination mechanism to present system (see Water Quality Council, Page 56).
- Can offer economic incentives for voluntary consolidations.
- Preserves local operational prerogatives.
- Minimizes change and disruption.
- Heavily dependent on cooperation.

(3) CONSOLIDATED OPERATING SYSTEM

- Continued operation of large systems with consolidation of smaller operations.
- Discourages establishment of additional small service districts for wastewater treatment.
- Encourage more extensive use of service by contract.

(4) WATER BASIN SYSTEM

- Establishment of large special districts conforming generally to natural watersheds.
- City of Houston and other large cities and operators would continue present operations.
- Acknowledges different characteristics of each watershed and deals with natural boundaries.
- Most difficult to implement; may require legislation.

RECOMMENDATION: PRESENT SYSTEM COORDINATED

NONPOINT SOURCE CONTROL MANAGEMENT ALTERNATIVES

- P.L. 92-500 is the first time nonpoint source has been addressed as a specific water quality concern.
- No formal structure has been designated to deal with nonpoint sources on an areawide basis in the Greater Houston Area.
- State has authorities to regulate and permit and has delegated to cities the duty to establish specific nonpoint programs (H.B. 1981, Sec. 26.177). State has shown preference for nonpoint source control at local level.
- Activities related to nonpoint control are being carried out in regard to other community considerations such as health, aesthetics and flood control.
- New field of investigation, studies performed in Texas and in this region have not adequately documented the extent of water quality effects of nonpoint sources nor proven the effectiveness of various control strategies.
- Nearly impossible to support <u>specific</u> recommendations regarding nonpoint control on an areawide basis at this time.

RECOMMENDATION: <u>MAKE FULL USE OF EXISTING AUTHORITIES AND ASSIGN HIGH PRIORITY TO PROGRAM</u>

Program activities to include:

(1) TEXAS DEPARTMENT OF WATER RESOURCES

- Establish wet weather water quality standards
- Verify and calibrate nonsteady state models
- Sampling and special studies in areas of particular concern

(2) LOCAL GOVERNMENT

- Encourage enforcement of existing ordinances such as erosion control, anti-litter, leash laws and building permits
- Consider use of subdivision plat approval and regulations to include nonpoint source control provisions
- Proper maintenance of sewer lines, storm sewers, drains and drainage ditches
- Encourage acquisition of linear greenbelt buffer zones

(3) WATER QUALITY COUNCIL (CONCEPT)

- Provide technical assistance to communities in developing nonpoint source control programs
- Share technical expertise and experience
- Sponsor special studies to verify region specific problems
- Oversee progress toward goal achievement

MANAGEMENT/COORDINATION ALTERNATIVES

(1) TEXAS DEPARTMENT OF WATER RESOURCES

- Performs this function for State water quality plans
- Existing staff and funding
- No need for new legislation
- Has provided coordination assistance in 208 effort
- Management/coordination function relates to local role in waste treatment management
- Expressions of support for performance at local level

(2) HOUSTON-GALVESTON AREA COUNCIL

- Directed by local elected officials
- Existing staff with 208 experience
- Lack of assured funding for this function
- Designated area only portion of area of jurisdiction
- Implementation role inconsistent with agency policy

(3) WATER QUALITY COUNCIL (Concept)

- Not currently in existence
- Would involve major participants in region and conform to P.L. 92-500
- Requires no legislation, can be implemented through interagency agreement
- Respects local operational prerogatives
- Makes full use of existing agencies and staffs
- High degree of flexibility

RECOMMENDATION: CREATE WATER QUALITY COUNCIL

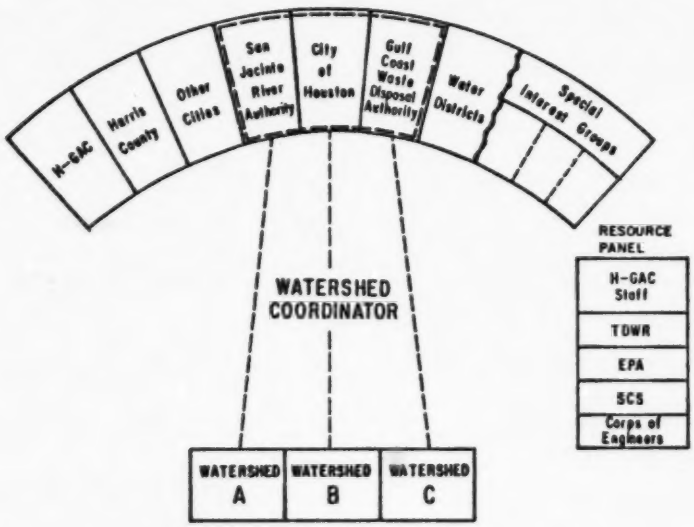
SUMMARY OF MANAGEMENT ALTERNATIVES/RECOMMENDATIONS

1. REGULATORY & COMPLIANCE PERMITTING MONITORING STANDARDS ENFORCEMENT	✓	TEXAS DEPARTMENT OF WATER RESOURCES (TDWR)
2. PLANNING		TDWR
	✓	H-GAC
		WATER QUALITY COUNCIL
3. WASTEWATER TREATMENT		PRESENT SYSTEM CONTINUED
OPERATIONS & MAINTENANCE DESIGN & CONSTRUCTION FINANCE	✓	PRESENT SYSTEM COORDINATED
		CONSOLIDATED OPERATING SYSTEM
		WATER BASIN SYSTEM
4. NONPOINT SOURCE CONTROL	✓	LOCAL GOVERNMENTS
ENFORCEMENT	✓	WATER QUALITY COUNCIL
TECHNICAL ASSISTANCE SAMPLING/SPECIAL STUDIES	✓	TEXAS DEPARTMENT OF WATER RESOURCES (TDWR)
5. MANAGEMENT /COORDINATION		TDWR
		H-GAC
	✓	WATER QUALITY COUNCIL

MORE ABOUT
THE WATER QUALITY COUNCIL...

The creation of a Water Quality Council is being recommended as the preferred alternative for the management/coordination functions. The concept of the water quality council has received initial support when presented during the alternatives screening process. The discussion which follows adds some clarification to the concept; however, details of composition and working procedures remain to be resolved. If the concept is approved, a detailing process will follow which incorporates input from the public hearings, as well as including involvement of the potential participants.

A schematic presentation of the Water Quality Council is presented below:



SUGGESTED FUNCTIONS/RESPONSIBILITIES

- Oversee 208 Update-Implementation
- Update local goals and objectives
- Input to Construction Grants priority list for 208 Area
- Input to A-95 Review
- Special Studies; 3.g., benthal loads, stormwater, stream aeration
- Review/comment municipal discharge permit application
- Input to water quality standards, waste load allocations
- Technical assistance to communities, developers, districts, operators
- Public participation/information
- Coordinate water quality concerns with other programs
- Forum for discussion of bond issues
- Oversee nonpoint source program
- Assistance in determining financing mechanisms
- No sewer rate issues
- Update local goals and objectives

MEMBERSHIP

Major Operators - City of Houston, Gulf Coast Waste Disposal Authority (GCWDA), San Jacinto River Authority (SJRA)
- have extensive areawide authorities
- independent financial base
- experienced in plant operations
- likely role as watershed coordinator (see next page)

Other Cities - (possible appointment by Harris County Mayor's Association)
- extensive waste treatment authorities
- implement nonstructural controls
- will be impacted by long-term policies, programs, and regulations
- revenue raising abilities and authorities

Harris County
- represent population in unincorporated areas
- pollution control activities and enforcement
- coordination of flood control and parks and recreation projects with water quality

H-GAC
- represent locally-elected officials
- can represent counties in designated area outside Harris County
- coordinate with ongoing 208 planning

Water Districts
- approximately 350 water districts in 208 area, each with authority for waste treatment
- currently no mechanism for coordinating actions

Special Interest Groups
- ombudsman role
- participant(s) might represent consumer interests, industry, developers, and environmentally-oriented groups
- nature of participation to be determined

In addition to full council membership, there will be a Resource Panel comprised of the following:

H-GAC Staff
- proposed to be responsible for 208 plan update
- A-95 review responsibilities (involves review of Federally-funded projects for conformance to regional 208 plan)
- provide administrative staff support for the water quality council; i.e., arrange meetings, provide minutes, etc.
- provide for public participation in both plan update and Water Quality Council activities

Texas Department of Water Resources (TDWR)
- provide technical assistance
- assure conformance with State Water Quality Management Plan
- represent designated agency for Regulatory and Compliance functions

Environmental Protection Agency (EPA)
- National and regional water quality policy information
- potential funding source for facility construction and planning activities
- provide technical information and assistance

U.S.D.A. Soil Conservation Service (SCS)
- experience and expertise in application of nonstructural controls, particularly erosion control
- can assist in designing funding and monitoring test programs

U.S. Army Corps of Engineers (ACE)
- involved in flood control and channel improvement projects
- issue permits and contracts for dredging activities

WATERSHED COORDINATION

A key to long-term implementation in the Water Quality Council concept is the role to be played by the "Watershed Coordinator". Agencies so designated would assume primary responsibility for overseeing what takes place in a given watershed.

The merits of addressing water quality problems on a watershed basis have been demonstrated in the presentation of Technical Subplans.

At the present time, it is envisioned that the major operators (City of Houston, Gulf Coast Waste Disposal Authority, and San Jacinto River Authority) would assume watershed coordination roles. Input to be received during plan review may reveal other choices as well as indications of specifically preferred designations.

An agency slated to become a Watershed Coordinator will agree to fulfill related responsibilities. These agreements shall in no way contravene any other management authorities existing in the watershed.

A chief responsibility of each Watershed Coordinator will be to work with municipalities and water districts in preparing applications for Federal funds to aid construction of wastewater treatment facilities (201 Construction Grants Program). The Coordinator will assist in assessing incentives for developing joint waste treatment facilities among neighboring communities. The 208 Plan will be a principal reference in making such evaluations. The evaluations shall take place prior to clearinghouse (A-95) review by the H-GAC. A project which conforms with 208 Program recommendations should receive a priority advantage in the State's listing of projects eligible for Federal assistance.

The Watershed Coordinator will also serve as a "first stop" for engineers and developers seeking information for project work in a given watershed. This will provide a degree of organization that is presently lacking.

By this concept, the coordinating agencies would also be likely recipients of Federal/State grants for performing special studies called for in the 208 Program. Such arrangements would also be subject to interagency agreement and Water Quality Council review.

A final and most important function of each Coordinator would be to lead the way in developing corrective, nonpoint source programs in its area of authority and coordination responsibility. This would include (1) providing technical assistance, (2) performing special studies, and (3) implementing exemplary programs.

The prospect for expanding the designated 208 planning boundaries to encompass the entire San Jacinto watershed has been mentioned elsewhere in this report. If that were to become a part of the final 208 Plan, the coordination concept would be expanded accordingly.

IMPLEMENTATION...WHAT NEEDS TO BE DONE?

It has been stated earlier that one of the unique features of Section 208 requirements is that the plan be implemented. The initial 208 planning effort will contain a detailed presentation of all major actions which must be taken by the designated management agencies in order to bring about implementation of the recommended technical and management plans. Presented below are highlights of the implementation requirements being developed. These action items are organized by functional management group.

REGULATORY AND COMPLIANCE

- Identification of process by which Texas Department of Water Resources will incorporate 208 Program inputs.
- Identification of possible new permit variables.
- Identification of monitoring requirements and assignment of specific responsibility.
- Input to Texas Department of Water Resources regarding setting of wet weather standards.
- Statement of importance of proper enforcement.

PLANNING

- Presentation of work program for annual plan updates.
- Identification of special planning studies.
- Estimated budget and staff requirements.
- Public Participation Program.

WASTEWATER TREATMENT

- Description of facilities which must be constructed by time period and subbasin.
- Estimated costs and discussion of financing mechanisms.
- Identification of types of programs required to attain proper Operations and Maintenance.

NONPOINT SOURCE CONTROL

- Identification of nonpoint source problem areas and technical recommendations.
- Specific actions required to implement the plan will be identified. These will be in the main categories of data collection, modeling, and other studies.
- Description of existing authority for nonpoint source control so as to enable prompt implementation by those entities with appropriate powers.

MANAGEMENT/COORDINATION

- Details of Water Quality Council including composition, agreements, procedure, and statement of purposes.
- Estimate of Staff and budget requirements and funding sources.
- Presentation of work program for Water Quality Council.
- Development of citizen participation program.

ENVIRONMENTAL IMPACT

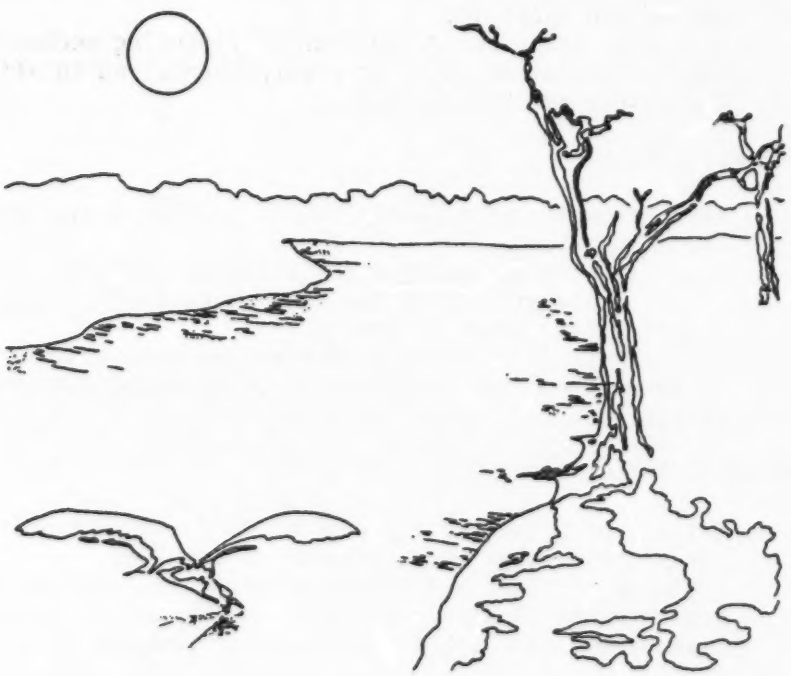
The National Environmental Policy Act (NEPA) requires that environmental considerations be included in decision making processes concerning Federal projects and activities. In order to incorporate these considerations, it is necessary to develop a complete understanding of the possible and probable consequences of a proposed action on the environment.

The concept of "environment" includes many aspects of resources both natural such as air, water, plants, and animals and man-made such as transportation systems, land use characteristics, community structure, and economic stability. Both the physical and social/economic elements of the environment must be considered in impact assessment.

Activity is underway to assess the environmental impacts which would result from implementation of the recommended Greater Houston 208 Plan. This assessment is intended to fulfill a portion of the requirements of Section 102(2)(c) of the National Environmental Policy Act of 1969. It must be noted that the assessment prepared for the 208 Plan will not be a detailed, site specific statement--the designated 208 area encompasses about 2,500 square miles, and the plan does not make site specific recommendations. Construction related to the plan will be evaluated on a case-by-case basis prior to implementation.

The 208 Plan is based on accommodation of growth that is projected to occur over the 20-year planning period. In most cases, therefore, the impacts that are predominant are those resulting from growth and changing land use patterns and not from plans for waste treatment management.

The environmental impact assessment for the Greater Houston 208 plan will highlight areas of particular concern as well as present potential adverse and/or beneficial results to be expected from plan implementation. The final assessment will be presented by major subbasin to relate to other plan findings and recommendations.



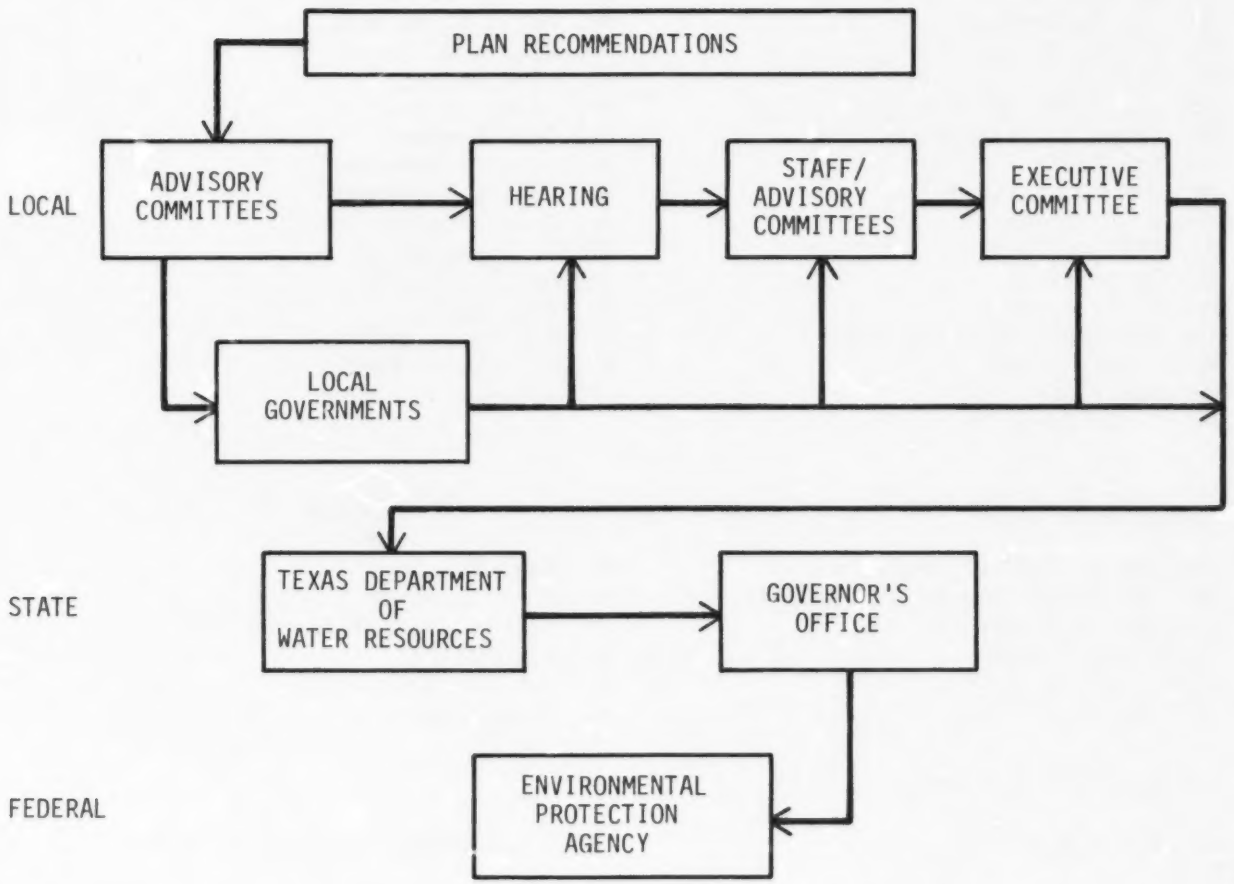
WHO WILL REVIEW AND APPROVE THE PLAN?

Under the requirements of Section 208 the Governor must certify the plan prior to submittal to the Environmental Protection Agency. For the Houston Area program the deadline for EPA submittal is April 22, 1978. On the local level, the plan will be recommended to the Governor by the Executive Committee of the Houston-Galveston Area Council. At the State level the Texas Department of Water Resources must review the plan and make a recommendation to the Governor.

Prior to these actions extensive local review takes place both by elected officials and the general public. Public participation has been a significant part of the entire planning process with special advisory committees established to assist in ongoing review of all aspects of the plan. A listing of the members of the Advisory Committees and the H-GAC Executive Committee is on the following page. The Citizens Advisory Group is an open committee with no formal membership; anyone can participate, and meeting notices are widely distributed.

In addition formal public hearings are held on major plan elements such as population and land use, alternatives and recommendations, and the final plan. Wherever possible, information has been summarized for broad distribution. However, the complete text of all plan reports is available for public review at depositories located throughout the region (a list of depositories is on inside back cover).

THE REVIEW AND APPROVAL PROCESS



GREATER HOUSTON 208 PROGRAM PARTICIPANTS

EXECUTIVE COMMITTEE OF THE HOUSTON-GALVESTON AREA COUNCIL (1977)

The Honorable Benjamin Babovec
The Honorable Tom Bass
The Honorable O tha Birkner
The Honorable J. H. Brigance
The Honorable Dee Brune
The Honorable Lynn Coker
The Honorable Dan Cox
The Honorable Lester J. Cranek
The Honorable Ralph Davis
The Honorable Charles T. Doyle
The Honorable Homer Ford
The Honorable Harlan Friend
The Honorable Richard Frey
The Honorable J. R. Harrison
The Honorable William Harwell
The Honorable Fred Hofheinz
The Honorable Ray Holbrook
The Honorable Benny Howard (President)
The Honorable Jon Lindsay
The Honorable Floyd Myers
The Honorable Lee Mendenhall
The Honorable Johnnie Putska
The Honorable Tom Reid
The Honorable Daniel Sklar
The Honorable Everett Tomlinson
The Honorable Mary Wilbanks
The Honorable John Unbehagen

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Mr. Jack Ayer
Mr. Malcolm D. Bailey
Mr. Don Betterton
Mr. Jimmie D. Coker
Mr. William E. Colbert
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Mr. R. Wayne Smith
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Mr. John Watts
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Mr. William G. Wooley
Mr. William W. Wright

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Mr. Marty Manning
Dr. Jack V. Matson
Mr. Lind Nelson
Mr. Enrique Quevedo
Mr. James Green

CITIZENS ADVISORY GROUP

Mr. Ray Runnels (Chairman)
Mr. Bruce Thomson (Vice-Chairman)

LIST OF DEPOSITORIES FOR PROGRAM DOCUMENTS
GREATER HOUSTON AREA 208 PLANNING PROGRAM

Federal

U.S. Environmental Protection Agency, Region VI, Dallas, Texas
U.S. Army Corps of Engineers, Galveston District Office
U.S. Department of Agriculture, Soil Conservation Service, State Office, Temple, Texas
U.S. Department of the Interior, Southwest Region, Albuquerque, New Mexico

State

Texas Department of Water Resources, Austin, Texas
Texas State Soil and Water Conservation Board, Temple, Texas
Texas Department of Health, Austin, Texas
Texas State Library, Government Publications Section, Austin, Texas

Regional

Houston-Galveston Area Council Library, Environmental Planning Department, Houston, Texas
Texas Department of Water Resources, District 7 Offices, Deer Park, Texas
Harris-Galveston Coastal Subsidence District, Houston, Texas
Gulf Coast Waste Disposal Authority, Houston, Texas
San Jacinto River Authority, Conroe, Texas
Clear Creek Basin Authority, Houston, Texas
Texas Department of Health, Region VII Office, Richmond, Texas
USDA Soil Conservation Service, Regional Office, Rosenberg, Texas
* U.S. Environmental Protection Agency Library, Region VI, Dallas, Texas

County

Brazoria County Library System, Angleton, Texas
(serving branches in Angleton, Alvin, Clute, Freeport, Lake Jackson, Pearland, Sweeny, and West Columbia, Texas)
Galveston County Library System, Headquarters in Rosenberg, Texas
(serving branches in Dickinson, Friendswood, Hitchcock, La Marque, League City, and Rosenberg, Texas)
Harris County Library System, Houston, Texas
(serving branches in Houston, Channelview, Crosby, Galena Park, Highlands, Humble, Jacinto City, Katy, La Porte, South Houston, Tomball, and West University, Texas)
Fort Bend County Library System, Richmond, Texas
(serving branches in Richmond, Needville, and Stafford, Texas)
Montgomery County Library, Conroe, Texas
(serving New Caney Branch Library)
Waller County Library, Hempstead, Texas
(member, Houston Area Library System)
Galveston County Health Department, La Marque, Texas
Harris County Flood Control District, Houston, Texas
Harris County Pollution Control Department, Houston, Texas
Harris County Health Department, Houston, Texas

Specific

City of Houston Public Works Department
City of Houston Health Department
City of Houston Policy Planning Division
City of Pasadena Public Library
City of Baytown, Sterling Municipal Library
Bellaire City Library
Rice University Library, Documents Department, Houston, Texas
University of Houston Library, Documents Department, Houston, Texas
University of Houston, Clear Lake City Library, Houston, Texas
Texas Southern University Library, Reference Department, Houston, Texas
Prairie View A & M University Library, Documents Department, Prairie View, Texas
North Harris County Community College Library, Houston, Texas
San Jacinto Junior College Library, Reference Department, Pasadena, Texas
University of Texas Health Science Center, Houston, Texas
City of Houston Public Library
(serving 26 branches throughout the Greater Houston Area)
USDA Soil Conservation Service, Houston Office
Houston Audubon Society Reading Room
Museum of Natural Science, Public Reading Room, Houston, Texas
League of Women Voters of Houston Office
Citizen's Environmental Coalition Office, Houston, Texas

* One copy to be included in the National Technical Information Service (NTIS) System